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Traffic Lights and Arterial Roads

This is an age of speed, but this trite observation needs qualification, because so many factors now enter into affairs, which make matters take on a slow-motion aspect. If Londoners are in a hurry, they walk, as in the city the high-powered motor omnibuses, because of traffic congestion, cannot do journeys as quickly as did the antique horse-drawn vehicles. Inter-city journeys are quicker by train than by aeroplane, because the latter cannot reach the centres of the towns. Even the trains are not so fast as they were in 1913, presumably because of congestion. It is not, however, only in the realms of transport that deceleration is so obvious—it also is apparent in general business. At one time, when a customer wished to place an order for castings, the foundry owner immediately quoted a price and delivery. To-day, on the receipt of an enquiry, first there is acknowledgment stating that it is receiving "our best attention." Then it goes to a desk provided with a plethora of telephones. There are calls to half-a-dozen colleagues controlling price, production, design, delivery, credit, the district representative, the patternshop, and so forth. Only the small jobbing foundry owner is in a position to emulate his grandfather and say immediately what he can do.

Take another field of activity, wherein a plant extension is envisaged. In the more leisurely days plans were prepared, submitted to the local municipal authority, and when passed the contract was placed and progress was made. To-day, the process resembles a game of rummy or coon-can, wherein one collects, instead of a run or four of a kind, a complete set of permits and licences. Then if the game goes well, one can after much finesse proudly display a winning sequence and cash in. The speed with which business was done in the old days would amaze the modern executive. For instance, thirty years ago, it was decided, on a Monday, to sell a furnace. Two telephone calls brought the buyers, and the higher bid was accepted. By Wednesday, dismantling was begun, and on Friday, the seller being short of cash for the payment of wages, the buyer settled the account. To-day, there would have to be consultations with colleagues, confirmations and insistence upon official times for the payment of accounts.

We would strongly urge the executives, especially of the larger concerns, to make serious efforts to speed up business by every means possible. By delegating true responsibility to the staff, permitting them to take risks, they might lose money here and there, but in the long run, the better service given would pay handsome dividends. It is advisable to ensure, unlike the big cities, serviced for planes somewhere in suburbs, that buyers do not make contact with the periphery of one's business and then penetrate slowly to the centre. Too many managing directors are so busy with committees, with internal organisation, with social amenities, and a hundred and one activities to be associated with the control of a business, that they forget that unless they obtain orders and maintain deliveries as promised, they will ultimately have no business to manage. Let them study the methods of their grandfathers and they will find business will be interesting and profitable. Bottlenecks exist just as much in peace as in war and their effect is just as grave. Five desk telephones may act like traffic lights, but the business man should convince himself as to whether the construction of a new arterial road would not be preferable. After all this is an age of speed!

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Leaders of the Industry

Miss L. Verity, M.B.E.

Miss L. Verity, who first took over the secretaryship of the local malleable ironfounders' association in the period between the two world wars, is now secretary of the National Association of Malleable Ironfounders. This post she has held since she assisted the late Mr. A. E. Hurst to form the Association in 1940.

Miss Verity is a native of Yorkshire, but has been associated in commercial spheres with the malleable-iron producing centre of Walsall, Staffordshire, for a number of years. It is here that the offices of the National Association are situated. She was appointed secretary of the Walsall Chamber of Commerce and later of the Walsall Malleable Ironfounders' Association. Amongst other public appointments, she has been for many years a member of the Walsall National Savings Committee, she is a member of the Walsall local advisory committee to the Ministry of National Insurance, and is secretary of a number of other trade associations. During the war period she was a Board of Trade Deferment Officer and was awarded the M.B.E. in the January, 1944, Honours List.

There are but few cases where ladies have become prominent in the foundry industry, but Miss Verity well merits inclusion in our "gallery" as, through her organising ability and charming personality, she enjoys the confidence and respect of a very large circle of manufacturers of malleable iron castings.

Dinner

Institute of British Foundrymen Sheffield Branch

Mr. J. C. Bailes presided over the annual dinner of the Sheffield branch of the Institute of British Foundrymen, which was held at the Royal Victoria Hotel last Monday. Amongst those participating in this record function were:—The Master Cutler (Mr. W. R. S. Stephenson), Mr. N. P. Newman, J.P., Mr. T. A. McKenna, Mr. F. A. Martin, O.B.E., Professor H. W. Swift, M.A., D.Sc., Mr. Milne, Dr. C. J. Dadswell, Mr. V. C. Faulkner, Mr. T. Makemson, M.B.E., Mr. Ambrose Firth, Mr. T. Firth, and Mr. G. L. Oxley. Mr. J. H. Pearce was responsible for the arrangements.

AN EXHIBITION illustrating the development of the National Physical Laboratory during the past 50 years was on view at the Royal Society, Burlington House, London, W.1, on January 30. Each Division of the Laboratory was represented. The exhibition forms part of the celebrations to mark the Jubilee of the N.P.L., which was founded on January 1, 1900.

Forthcoming Events

FEBRUARY 6.

Institute of British Foundrymen.

Sheffield Branch:—"Economic Geology in Relation to the Foundry Industry," by W. J. Hughes, at the Royal Victoria Station Hotel, Sheffield, at 7.30 p.m.

Bradford Engineering Society.

"Engineering Works Management," by P. Evans, at the Bradford Technical College, at 7.30 p.m.

Institution of Production Engineers.

Yorkshire Section:—"Industrial Finishes," by C. F. Hennessey and C. C. Gladwell, at the Hotel Metropole, King Street, Leeds, 1, at 7 p.m.

FEBRUARY 7.

Institute of British Foundrymen.

Burnley Section:—"Manufacture of High-silicon Iron Castings for the Chemical-engineering Trade," by G. Ward, at the Accrington Grammar School, Burnley Road, Accrington, at 7.30 p.m.

Chemical Engineering Group.

"The Manufacture of Titanium Pigments," by W. H. Coates, B.Sc., at the Geological Society, Burlington House, Piccadilly, London, W.1, at 5.30 p.m.

Keighley Association of Engineers.

"Industrial Radiography," by Dr. L. Mullins, M.Sc., at the Lecture Hall, Technical College, Bradford, at 7.30 p.m.

FEBRUARY 9.

Institute of British Foundrymen.

Lincolnshire Branch:—"Notes on American Foundries," by F. W. Nield, at the Lincoln Technical College, at 7.15 p.m.

East Anglian Section:—"The Manufacture of a Large Pulley Wheel in Aluminium Alloy," by W. Wilson and A. Talbot, at the Central Hall, Public Library, Ipswich, at 7 p.m.

Institute of Metals.

London Local Section:—"Recent Developments and Modern Technique in Metallurgical Analysis," by E. J. Vaughan, M.Sc., A.R.C.S., D.I.C., at 4, Grosvenor Gardens, London, S.W.1, at 7 p.m.

FEBRUARY 10.

Institute of British Foundrymen.

Middlesbrough Branch:—"Synthetic Resin Core Binders," by G. L. Harbach, at the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7.30 p.m.

Manchester Association of Engineers.

"Boiler Feedwater Treatment for Low or Medium Pressures, with Special Reference to High-pressure Boilers," by P. Hamer, B.A., A.I.C., at the Engineers' Club, Albert Square, Manchester, 2, at 6.45 p.m.

FEBRUARY 11.

Institute of British Foundrymen.

Lancashire Branch:—"Where is Cast Iron Going to?" by P. A. Russell, B.Sc., F.I.M., at the Engineers' Club, Albert Square, Manchester, 2, at 3 p.m.

Newcastle Branch:—Visit to Elswick, Newcastle-upon-Tyne, Works of Vickers-Armstrongs, Limited, at 10 a.m.

Scottish Branch:—"The Moulding and Testing of Non-ferrous Hydraulic Castings," by W. Thomson, at the Royal Technical College, George Street, Glasgow, at 3 p.m.

Unusual "Foundry" Visits

Last Wednesday, after hearing Mr. F. Sievewright's Paper on foundry education, members of the London branch of the Institute of British Foundrymen made up parties for visiting the "Daily Mail" and "Daily Express" organisations to see the printing of newspapers. The arrangements were made by the proprietors of the FOUNDRY TRADE JOURNAL. Much interest was shown by the visitors in all the processes, but they were particularly impressed to find that, in the printing trade, casting of metal is a "white-collar" job. The moulding of the circular drums of type on *papier maché* and subsequent casting in metal was also much admired. As is often found with well-run concerns, full appreciation of the speed of production was masked by the precise synchronisation of operations. About 50 members participated; they saw the papers "put to bed," exchanged greetings with the regional offices of the newspapers, and left just before midnight. The visits were much appreciated as being among the most interesting of recent times.

Gating Systems and the Production of Some General-engineering Castings

By W. Collinge

Initially it is stressed that, as there are so many varieties and designs of castings, it must be recognised that standard gating systems are not applicable to any design of casting. Each year it is increasingly recognised that the responsibilities of the foundry executive become more and more important and the production of sound castings depends on the methods he uses. The Author gives details of methods which have been developed for producing a range of castings for flameproof electric motors and an "Index" automatic machine. The Paper was read before the Bristol and West of England branch of the Institute of British Foundrymen, Mr. J. R. Hayward presiding.

IN the past, attempts have been made to standardise gating by measurement* but again there is the design of the gating to consider in comparison with the design of the casting to avoid turbulent and concentrated gating which produces dross resulting in dirty castings. There is also to consider equal cooling, so avoiding stresses set up due to unequal contraction. Shrinkage and consequent soundness must also be taken into account.

Flameproof Electric-motor Castings

Flameproof electric-motor castings are subjected to 200-lb. pressure test; they are in the 16 tons tensile range and have a fairly quick freezing range, any sign of gas, dirt, or porosity in the interior of these castings involving rejection. The guarantee of these motors is such that they call for a high degree of inspection and must be to the entire satisfaction of the chief inspector. Having just completed an order for 12,000 of these motors gives real satisfaction as to the application of the methods used in their production.

Flange Bracket

The flange bracket shown in Fig. 1 is a component for the flameproof motor. It caused much trouble through scabbing, although permeability of the moulding sand used was of the order of 60. This was earlier run by various gates from the joint which obviously caused a turbulent flow by washing the surface of the mould. On introducing the breaking system, scabbing was immediately eliminated and a very nice casting resulted.

From Fig. 2 it will be seen that down-gates are introduced down the side of the core, the metal entering at eight different in-gates thereby ensuring an easy streamline effect which also eliminates the formation of dross. Moreover, its steady rising action drives the gas before it in its ascent.

The core inserted in the mould as is shown in Fig. 3 is made from silica sand. No irons were used; having a high dry strength it was found they are unnecessary. It should be noted that hand-holes are introduced on the side of the mould to simplify the method of insertion. These castings were produced on a Stone-Wallwork jolt squeeze draw machine and about 500 per week are produced. The weight of this casting is 28 lb. The casting temperature used is about 1,380 deg. C. The moulding sand has the following properties: Permeability, 55; moisture content, 5 per cent.; green strength, 8.5 lb. The average wall section is about ¼ in.

*Dr. E. M. H. Lips, Proc. of the Institute of British Foundrymen, Vol. XXXII, 1938-39. Paper 661.

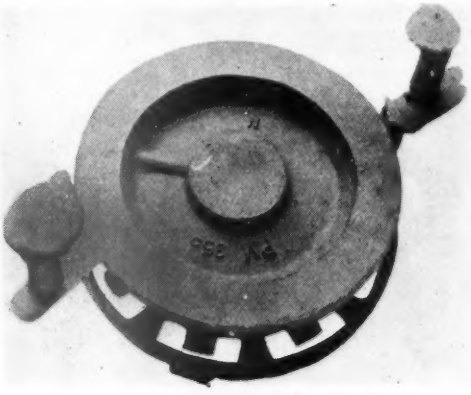


FIG. 1.—SHOWING THE GATING OF A FLANGE BRACKET.

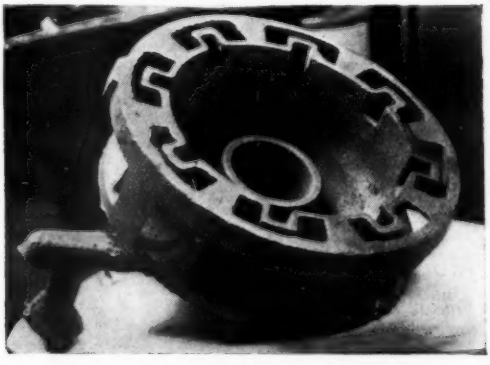


FIG. 2.—SHOWING THE EIGHT IN-GATES USED.

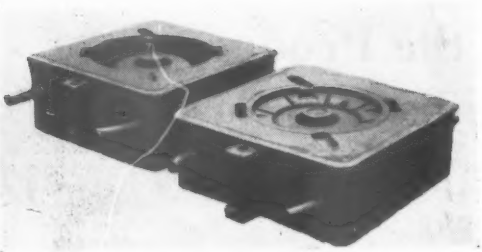


FIG. 3.—INSERTION OF THE CORE FOR THE END FLANGE.

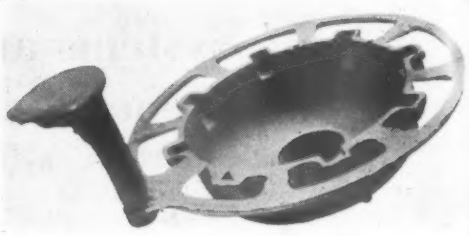


FIG. 5.—METHOD OF RUNNING THE COVER CASTING.

End Bracket

Fig. 4 shows the end bracket for the flameproof motor component. These are produced on the same type of machine as for the flange bracket. These are gated by pencil runners from the boss at the top. The reason why the breaking system has not been introduced on this casting is because it requires hot metal at the top to eliminate shrinkage in the boss, which was encountered when using the breaking system. The metal during its ascent decreased considerably in temperature and after a very short time a crust had formed on the top of the boss long before the lower portion, there not being sufficient metal to feed the affected part causing a defect in the boss. About 300 castings per week are produced and each weighs 48 lb. The casting temperature is controlled at 1,380 deg. C. The sand has the following properties: Permeability, 60; moisture content, 5.0 per cent.; green strength, 9.0. The wall section is of the order of $\frac{7}{16}$ in.

Cover Component

The cover component of the flameproof motor is shown in Fig. 5. It is also produced on the same type of machine and again the breaking system is used. This serves a dual purpose, not only producing a sound casting but also producing a sound one from the point of equal contraction. As shown between the protruding parts or lugs of the casting, a stress is set up on cooling and earlier gating systems have caused a hot spot which subsequently produced a crack, this being the last portion to cool pulls away between the brackets and in some instances cracks have appeared on each side of the gate proving that unless equal contraction is obtained all round a stress is set up. In the machine shop, prior to the introduction of this method, approximately 12 per cent. of these castings, when machined on the internal part (they have actually $\frac{1}{16}$ in. being turned off inside the top edge), resulted in excessive cracking. Prior to the introduction of this system, 20 to 25 per cent. scrap was registered, the major portion through cracking.

The section of this casting is $\frac{1}{4}$ in. thick and an increase in thickness was not allowed by the designer—so it was realised it was a difficult problem, yet the production was of the order of a thousand castings per week with this method. Incidentally, this casting has been made the opposite way up since this photograph was taken. The weight of this casting is 12 lb.: the casting temperature was controlled at about 1,380 deg. C. The sand properties were: Permeability, 60: moisture content, 5.0 per cent.: green strength, 9.0.

Stator Frame

Fig. 6 shows the stator frame casting for the flameproof motor. The appearance of dross or pin-holes in the interior involves immediate rejection. They are subjected to a 200-lb. pressure test. The breaking system was again the answer to potential troubles. This has two down-gates through the centre core, which is split into two halves, and in-gates are set up at eight different points where the two cores join, as is shown in Fig. 6. After shot-blasting the only sign of dirt found was always in the ring-gate serving the in-gates, but dirt is always present in the ring-gates on all castings, proving again that this method was cutting down and also trapping dross before its entry into the mould.

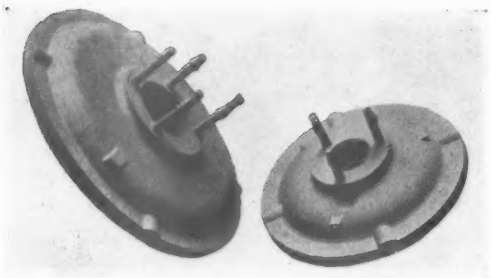


FIG. 4.—PENCIL RUNNERS USED FOR AN END BRACKET.

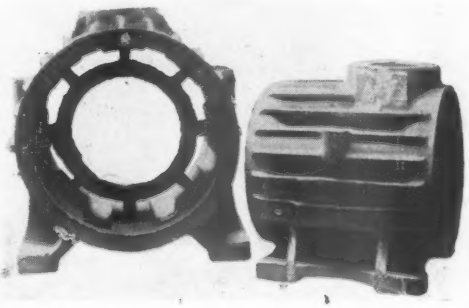


FIG. 6.—RUNNING METHOD USED FOR STATOR FRAMES.

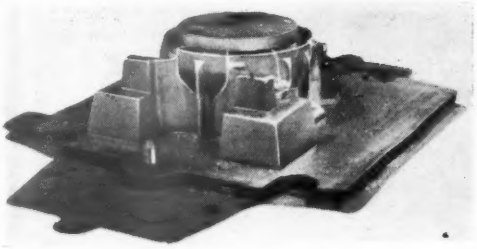


FIG. ".—HALF-PATTERN FOR THE STATOR FRAME.

The necessary cores are made in silica sand with a semi-solid compound, and on no occasion has there been any burning-in on the gates with the brand of core compound used. Moulding sand used in the production of these castings is of a low permeability; a high permeability is not required because of the small surface area. The green strength is 11 lb. on this job because it is required for a number of pieces that are drawn in on the mould. No springs or irons are used whatever. These are produced on the jolt-squeeze roll-over machine. The weight of this casting is 2½ cwt. and the casting temperature not lower than 1,380 deg. The sand used has the following additional properties:—Permeability, 40, and moisture, 5.0 per cent. Fig. 7 shows a half-pattern for this casting.

"Index" Automatic Machine

Fig. 8 shows the body for the "Index" automatic machine; the base of the machine will be illustrated later. The body is gated by six in-gates fed by two down-gates. It is a green-sand job produced on the jolt-turnover machine and contains 14 cores. There are eight risers and six denseners introduced on this particular casting, because of the uneven sections which make this an intricate job to produce. Even after applying these methods, pouring temperature must not be lower than 1,380 deg. C.; otherwise gas is encountered, together with internal shrinkage on the machined parts—these are apparently the heavy sections. The weight of this casting is 1 cwt. 3 qrs. 20 lb. The sand properties are:—Permeability, 55; moisture, 5.0 per cent., and green strength, 9.0. The wall section averages ¼ in.

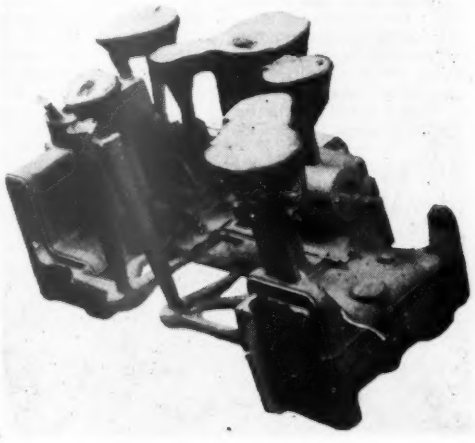


FIG. 8.—BODY CASTING FOR THE "INDEX" AUTOMATIC MACHINE AS CAST.

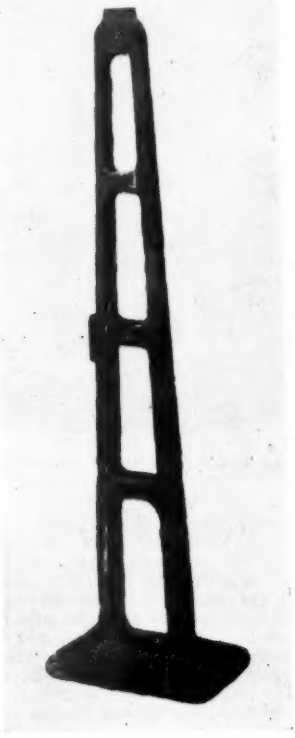


FIG. 9.—STAND CASTING AFTER FETTLING.

Stand

The casting shown in Fig. 9 is a stand for the "Index" automatic machine. This is entirely a green-sand job. The panels seen are produced by a green-sand core which is actually put in the mould by turning the core box into the bottom part of the mould, which is located by pins, *i.e.*, bottom and top part are rammed up on plate pattern, as is shown in Fig. 10. The top part is then removed and the pattern plate also. The core box is rammed up; after venting, the top portion of the core box is removed, leaving the bottom of the core looking upwards. The bottom part of the mould is then turned over and put on the core box, which receives the pins for location; the bottom portion of the mould is secured to the core box by clamps and turned over, leaving the core box on top. This is removed, leaving the green-sand core in the mould, as is shown in Fig. 11. The top part is then put on the bottom again and closed. Gates are put at the top end and two at the base of the casting. The running is from each end to ensure soundness in the boss, as this requires metal of high temperature. The weight of this casting is 30 lb. The sand properties are:—Permeability, 60; moisture, 5.0 per cent., and green strength, 9.0. The section thickness averages ¼ in.

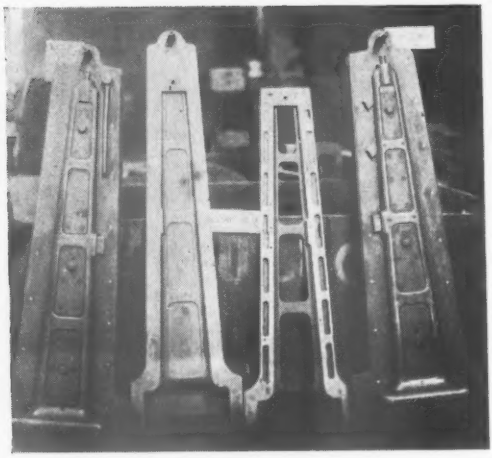


FIG. 10.—CORE BOXES FOR MAKING THE STAND CASTING.

"Index" Base

Fig. 12 shows the base component for the "Index" machine. The breaking system has again been used, but in a different way. Although gated from the top, it is broken into different channels, as is seen in the illustrations which follow. These castings are produced without studs to make sure no leakage is present. All the large cores are secured by bolts in the bottom and mid-section. These bases are rammed up on the large Pneulec Herman jolt-turnover machine of the 4,000-lb. type and given 8 hrs. in the drying stove. Fig. 13 shows the pattern for the bottom part of the casting; the pins are fitted with blocks for locating bolts. Fig. 14 shows one-half of the mould rammed up and immediately behind is the pattern.

Fig. 15 shows the actual box being rammed up, a ramming board being bolted to the box side to hold the sand during the jolting period. After ramming, the board is removed and the pattern drawn, as shown in Fig. 14. Fig. 16 shows the pattern of the top part of the casting. The rectangular blocks shown receive the runner cores, which contain three gates. Immediately behind is shown a sand skip on the gravity roller. This is pushed under the sand hopper, illustrated to the left of the roller track. It is filled with sand (taking 1 min.) and lifted by small overhead crane. The sand is released by pulling the lever down (which is shown on the side), filling the box ready to jolt. This operation

FIG. 11.—MOULD FOR THE STAND CASTING.

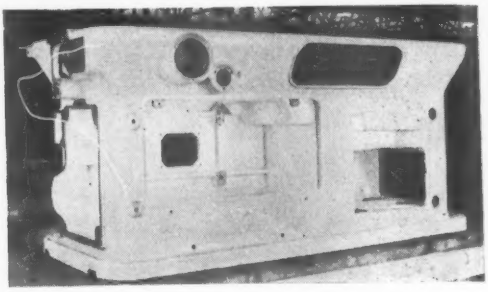


FIG. 12.—BASE CASTING FOR THE "INDEX" AUTOMATIC MACHINE.

takes 3 min. from the commencement of filling to emptying into the moulding box. Fig. 17 shows the bottom part and top part rammed up.

Fig. 18 shows all the cores that are placed in the mould and one core box, which have been purposely set apart. It also shows the core iron resting on the lugs ready for jolting. These lugs are locating points for the bolts and vents and are essential from the fact that no cutting or carving of the core is necessary when securing these cores after being placed in the mould. These lugs are located in every box. Boards are actually made with the core iron patterns attached, and all that is required is a soft bed on which the boards are placed, then knocked down and levelled. Fresh irons are cast each day. After the core iron is placed in the box, it is filled with sand and ashes put in their respective places, and then put on a jolting machine which was converted for core ramming. Incidentally, the prongs have been removed to give a clear view of the locating lugs.

Mould Assembly

Figs. 19 and 20 are sketches showing the method of assembly. These show the two halves bolted together, forming the middle part of the mould. They are turned over and set on blocks 2½ in. high on a special assembly plate. The cores are placed on to a stand and small trolley which gives the height required. No. 1 core is set resting on the trolley; it is then secured by four bolts. No. 2 follows and is dropped on to a stand and secured by three bolts. No. 3 is then placed on to a stand. The sketch shows it by a side view to be secured by two bolts. No. 4 is already secured to No. 1 before inserting. After securing these cores, the box is then lifted by the beam and pulley method and turned over again for Nos. 5, 6 and 7 cores to be inserted

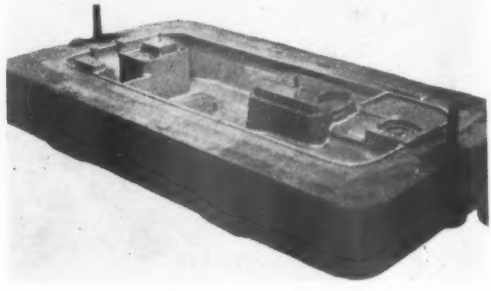


FIG. 13.—PATTERN FOR THE LOWER PART OF THE BASE CASTING.

FIG. 14.—ONE HALF OF THE MOULD RAMMED-UP, WITH THE PATTERN IN THE BACKGROUND.

and secured. No. 6 is secured by hook bolt and plate let in and secured to No. 1 core. Paste blacking is then smeared around on the hook hole in No. 1 core when No. 6 is lowered in, to ensure no metal enters through the joint. Cores Nos. 8, 9, 10, 11 and 12 are secured in the bottom by bolts, as shown in the second view. In each of the cores 1, 2, 3 and 7 vent pipes are inserted to ensure the quick escape of gas and also to prevent metal getting into the cores. Three pipes are inserted in No. 1, three pipes in No. 2, one pipe in No. 3 and one pipe in No. 7. These are rammed round with wet sand.

Fig. 21 shows the bottom half with the cores secured by bolts, and Fig. 22 illustrates the top part with the runner cores fixed in their respective places, forming a part of the mould. The top is turned over and two strainer cores are fixed over the down-gates to act as slag retainers. The runner box is then added to be made up prior to putting it on the middle part. Fig. 23 shows the gating on the casting, which is broken away to various parts of the mould, ensuring equal distribution of hot metal into the mould. The corner brackets, as in the panels, have been added to eliminate cracking, which sometimes occurs due to unequal sections inside.

Figs. 24 and 25 show the mould on which two parts are ready assembled to receive the top part. These two views are reproduced so as to illustrate each side of the mould showing the cores as they are secured by bolts. This should give a clear impression of the actual bolting of these jobs. Fig. 26 shows about 100 of these castings that have been produced by this method; these are actually kept at room temperature for six months until stresses have been relieved.

The weight of this casting is 14 cwt. and the pouring

FIG. 15.—RAMMING-UP OF A PART MOULD FOR THE BASE CASTING.

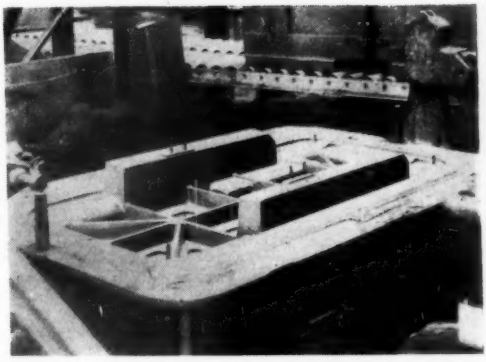


FIG. 16.—PATTERN FOR THE TOP-HALF OF THE BASE CASTING.

time 40 secs. The casting temperature should not be lower than 1,380 deg. C. The wall section averages $\frac{1}{2}$ in. The sand bottom for the half is controlled to give 55 permeability and 90 green strength. For the middle part the properties are 30 permeability, 11.0 green strength, and moisture 5 per cent. Fig. 27 shows the "Index" automatic machine complete with the Newman motor, and Fig. 28 shows a group of the flameproof motors.

Conclusion

In this Paper an endeavour has been made to show that, even if sand and metal are technically controlled, there still remains that major factor, correct gating.

In concluding, the Author wishes to thank his managing director, Mr. A. J. Newman, for his encouragement and permission to present this Paper, and also the directors and management of Newman Industries, Limited.

DISCUSSION

MR. POTTS (Chippenham) opening the discussion said that he thought the mixture of the sand used for the strainer cores must be a very good mix to resist a breakdown when the metal was running through. He (Mr. Potts) had found this to be so in his experience. He said that he would also like to know the analysis of the metal used for the large body casting.

MR. COLLINGE in reply said that the analysis for the "Index Base" was 2.5 per cent. silicon, 0.07 sulphur, 0.8 mânganese, 0.7 phosphorus, and 3.2 per cent. carbon. He said that he was using quite a quantity of low phosphorus irons and that quite a few customers at the present time were demanding low-phosphorus material.

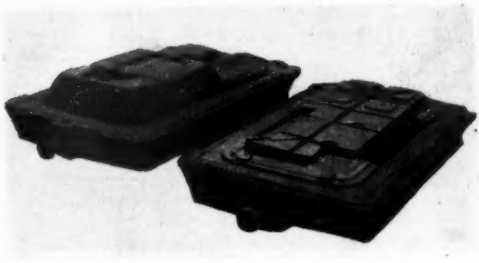


FIG. 17.—HERE BOTH THE TOP AND BOTTOM PARTS FOR THE BASE CASTING ARE SHOWN RAMMED-UP.

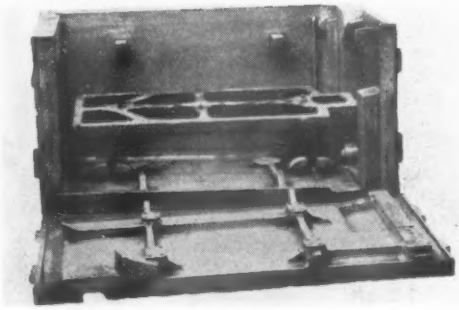


FIG. 18.—GROUP OF CORES FOR THE BASE CASTING AND A CORE BOX.

During the last seven months he had not had any complaints from the machine shop.

For the core-sand mix, eight shovels of Bromsgrove red sand was used, thirty shovels of silica sand and two pints of core compound and for the strainer cores two shovels of Fulbond was added to this mixture.

MR. POTTS asked if this was a semi-solid.

MR. COLLINGE said that he never experienced any burning in with this particular mixing and he was not going to say that it was a semi-solid compound, but it certainly had an advantage over the other compounds he had used, so much so, that he was very sceptical of using anything else in that particular line whilst casting at high temperatures.

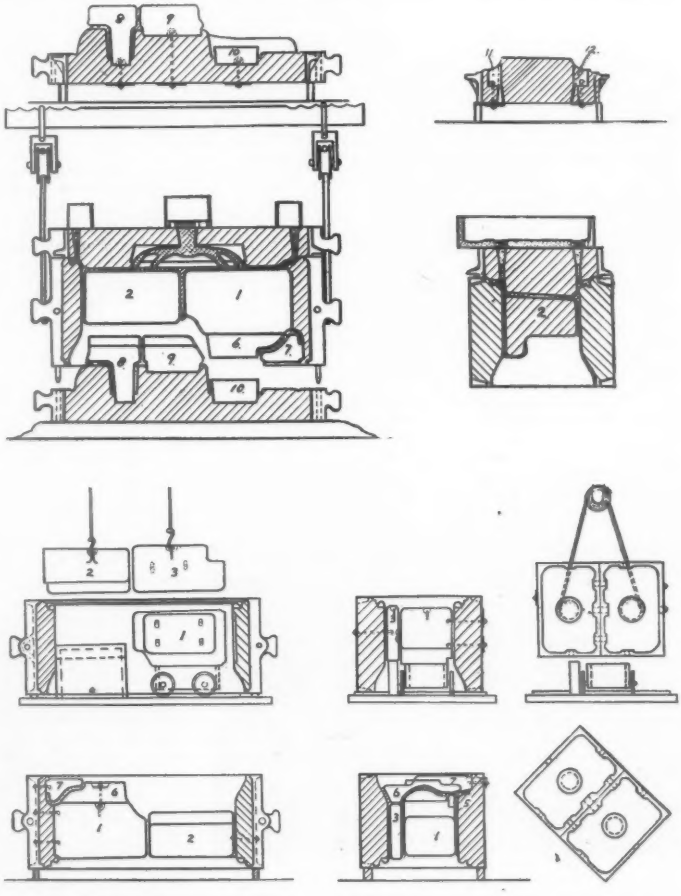
Round *versus* Rectangular Down-gates

MR. HAYWORTH (President) speaking regarding the down-gates on the "Index," said that in one instance he noticed a rectangular gate was used whilst for the majority of the others round-gates were introduced. He asked Mr. Collinge if he preferred a round-gate to a rectangular down-gate.

MR. COLLINGE replying said that he actually preferred a round-gate and that it was something very unusual for him to use a rectangular gate. He thought there was a tendency for loose sand to be trickling away from the corners into the mould when the rectangular form is used.

MR. ROBERTSON (Bristol) referring to Fig. 2 showing eight gates, asked if Mr. Collinge had taken into consideration the total area of the in-gate in this casting in comparison with down-gates and he would also like to know what provision was taken for keeping out slag.

MR. COLLINGE in reply said that he had pointed out in the Paper that down-gates in ratio with the in-gates were apparently something like—in area 1 in. to 1¼ in. square. As to dross entering the casting, on introduction of the breaking system it has a tendency to float



FIGS. 19 (UPPER) AND 20 (LOWER).—METHOD OF ASSEMBLY OF THE CORES.

FIG. 21.—BOTTOM PART MOULD WITH THE CORES SET.

in front of the down-gates in the ring and the moment it touches the surface of the ring it apparently sticks. As he had said previously on every one of the castings he had made he had found a considerable amount of dirt in the ring but this only proved that it was trapped before its entry into the mould.

Pouring Temperature

MR. ROBERTSON then referred to the pouring temperature. He said that 1,380 deg. was in his opinion fairly hot. He asked if there was any reason for this pouring temperature when there was a 0.7 phosphorus percentage.

MR. COLLINGE replying said that he tried to maintain this temperature because of internal shrinkage and the thin and thick sections prevailing plus the surface area of the casting Mr. Robertson had mentioned. Regarding the end cover with the pencil gates, after introducing the breaking system on the castings he found that due to lack of feed in the top this caused a segregation. He also found that the metal having to cover such a great area the temperature decreased considerably and on reaching the surface in the boss this was proved—this being the main reason why the metal was kept at 1,380 deg. However, at the same time he was quite prepared to admit that his coke consumption had increased slowly during the past few months whilst trying to maintain that temperature but the expense was justified.

MR. SHEPPERD (Bristol) referring to the end cover, asked Mr. Collinge if he thought that the eight in-gates introduced were all efficiently used as such.

MR. COLLINGE replying said that on the cover core No. 5 in-gates had actually been introduced because of excessive cracking and the need to eliminate dross. He had ascertained that if one breaks up so many

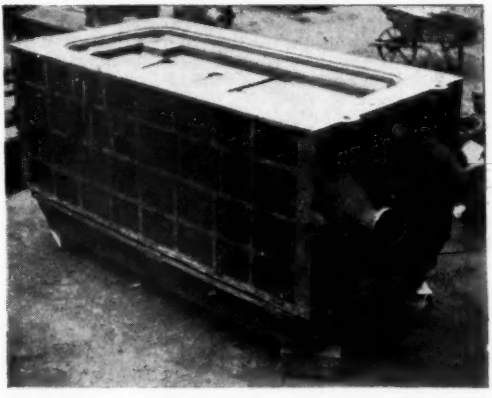
FIG. 22.—SETTING OF THE RUNNER CORES.

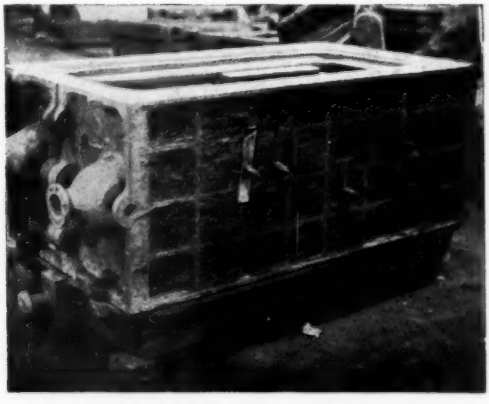
FIG. 23.—SYSTEM OF GATING USED.

in-gates into a mould one does not actually eliminate 100 per cent. dross but what one does get is spread out thinly over a greater area.

MR. SHEPPERD said that he assumed that when the castings were made there was no riser attached to them at all.

MR. COLLINGE said that no riser was used but just a whistler ¼-in. in diameter to avoid an air trap.





FIGS. 24 AND 25.—MOULD PARTIALLY ASSEMBLED READY TO RECEIVE THE TOP PART.

FIG. 26.—STOCK OF "INDEX" AUTOMATIC MACHINES DURING THEIR PERIOD OF WEATHERING.

MR. POTTS speaking as to No. 5 said that Mr. Robertson had touched on the same point, he (Mr. Potts) was rather surprised that the ring connecting the in-gates was in the bottom end; he would have expected it in the top. He would like to know if this was a complete ring or did it connect to the other end.

MR. COLLINGE in reply said that the ring supplying the in-gates is a complete ring. Recently he had turned over from making these castings that way up; it had actually been reversed, now being made concave with the gating ring actually in the top. At that time it was not, but it still worked efficiently.

MR. ROBERTSON said he noticed in the stator frame that there was an internal ring with four or five in-gates; he asked if this did not set up stresses by normal contraction.

MR. COLLINGE in reply said that the section on this casting is 1¼ in. Taking the wall section in comparison with the in-gates which are approximately 1 in. by 1¼ in. and it came in at different points. He did not think he had anything to fear from stresses in this case.

MR. ROBERTSON said he would have thought that was all the more reason.

FIG. 27.—FINISHED "INDEX" AUTOMATIC MACHINE.

FIG. 28.—GROUP OF "NEWMAN" FLAMEPROOF MOTORS READY FOR DESPATCH.

MR. COLLINGE, continuing, said that he found a few of the in-gates were broken, which denoted that the wall section, being the thicker part, was pulling away.

Running at the Boss

MR. BARNS (Bath) asked why the castings were run from the boss when it is an old foundry axiom that such castings should be run from the thinnest section.

MR. COLLINGE, in reply, said that in the first place after trying a series of gates on this particular casting, even at very high temperature, only 25 per cent. could he say were really good, and that he was a great believer in high-temperature casting. He said that as they knew the phenomena of liquid shrinkage and liquid contraction, there was something between the two that was really imperative, and that was the heat, and from that one obtained uniform shrinkage and equal solidification.

MR. SHEPPERD said he could not appreciate why the casting was gated on the boss. However, he thought he could see one reason why, that being, that when there was hot metal at the top and slightly cooler metal at the bottom there resulted a more equal solidification.

MR. COLLINGE replied that in his experience he had always found that where there was hot metal at the top there was never any internal shrinkage.

MR. ALLCOCK (Newport) agreed with Mr. Collinge that the hotter the metal the better the casting in every respect, especially where high-speed machining was utilised, as was the case with Newman Industries.

MR. COLLINGE said that he fully agreed with Mr. Allcock's statement, and that this particular method does suit high-speed machining; the use of low phosphorus irons seemed to ease the position in some instances.

"Green" or "Dry"

MR. ROBERTSON, referring to the "Index" machine body, said that Mr. Collinge did not mention whether it was green or dry sand. Why the different permeabilities of sand and why was the middle made in two halves; also would it not have been possible to have blocked it out and made it all in one?

MR. COLLINGE, in reply, said that he thought Mr. Robertson had mis-interpreted his (Mr. Collinge's) previous remarks, and that this mould, "Index" automatic" machine base, was given eight hours in the

(*Continued on page* 122.)

Loam Moulding of an Evaporator-body Casting

Discussion of Mr. W. H. Hornby's Paper

After Mr. L. Handley's address to the Lancashire branch of the Institute of British Foundrymen, Mr. W. H. Hornby presented his Paper on loam moulding of an evaporator body casting (printed in the* JOURNAL, *May* 12 *and* 19, 1949). *This described the tackle required and the moulding method, step by step, for a complicated, 8½-ton casting at the works of Worthington-Simpson, Limited, Newark. What follows is a slightly abridged report of the Discussion which took place at Manchester.*

MR. STOTT said that from the illustrations exhibited by Mr. Hornby, it was obvious that a great deal of planning and thinking was devoted to the casting before the mould or core was started. What guidance was given to the people starting the job?

MR. HORNBY said there was at their foundry a system established by which everyone concerned received details about each job. There was one set of drawings made for the entire job; for machining, patternmaking, moulding, all were shown on the one drawing. He admitted that this sounded rather complicated, but the whole job, initially, was discussed between patternshop and foundry. It was decided which way the job was going to be made and what pattern equipment would be required. A patternmaker, well into the sixties, acted as a liaison officer between the patternshop and the foundry. He had a little shop in the foundry and a bench in the patternshop. He assisted in the location of the skeleton patterns and prints and was on hand to check metal section when the mould was being closed. It could not be described as a foolproof system, but it was a very good one and very few mistakes were made. There was no real set formula, apart from the fact that everything was done as the result of experience. In reply to a further question, from Mr. Stone, Mr. Hornby stated that the sweeping up of the mould was done by a revolving spindle.

Sand Permeability

MR. LAWSON said that much had been heard about the permeability of dry sand. According to the technical Papers presented during the past few years, it appeared to be more or less decided that loam was relatively impermeable. Was this so in fact? Assuming that it was so, what was the explanation for the fact that some of the really high-class castings were produced in loam? Why was it so important, as they were told, that there should be permeability in a normal moulding sand?

MR. HORNBY said that quite a number of people criticised the practice of using a very close-grained sand like Mansfield, which contained such a high clay content, but this was offset by a large addition of organic bonding material. It was very seldom that there were any scab castings, and when there were any, they could be traced to a deficiency of the organic bonding material or to insufficient drying. He had mentioned that the drying had to be lengthy because such a fine-grained sand as Mansfield was used. Mansfield red was the base for both loam- and dry-sand work.

MR. E. LONGDEN stated that permeability of the sand was necessary in order to take away gases. If there was a minimum amount of gas, then the permeability could be reduced. There were sands which had a smaller grain size and had a considerably reduced permeability. A point which was very often overlooked was that, if no gases were formed in the sand, then there would be no need for permeability. A large amount of sand was being used to-day in which the permeability was very low indeed.

*Printed in last week's issue.

Answering MR. ROLLITT, MR. HORNBY said that, when a new job came along, it was usual to find that a casting somewhat similar to it had been made some years previously. It was surprising what a good memory the moulder and foreman had in such cases.

Tackle for Strickling

MR. H. HAYNES said he always gave credit to a loam moulder for knowing precisely what to do whether in the case of a small or a large casting. Mr. Hornby had exhibited some splendid illustrations of elderly moulders demonstrating their craftsmanship. He would like to see more apprentices trying their skill at such jobs. When he was 25 years of age, he made a large condenser, weighing 15 tons, in loam, and he thought other young men ought to be given a similar chance.

He had noticed that with the arm on the spindle, which was said to be about 12 ft. high, there was provided tackle for steadying the spindle at the top. Also, the arm which carried the board had a screwed-on collar with a nut. If it was desired to take the seating board right up from the bottom, then he would suggest having an arm with a slot in to screw it up, and then, if it was necessary to take the seating board out, it was only necessary to unscrew the nut. All had different ideas sometimes, but the real test was the production of good castings. It did not matter so much how they were made as long as they fulfilled requirements.

MR. HORNBY appreciated Mr. Haynes' views about the spindle arms. An arm with a solid core right down was used and, at times, it was necessary to take the arm off the spindle. He did not think Mr. Haynes' idea had been tried out at his foundry, but he would certainly bear it in mind.

Regarding apprentices, there was one employed on the job of the half-condenser, but unfortunately he did not like loam moulding, so he had to be put on ordinary moulding rather than lose him. At present, they had about six loam moulders, and perhaps in the course of four or five years they would experience a shortage due to lack of suitable apprentices. Three of his men were over 60 years of age; young men who were interested in loam moulding could not be found. Some of the moulders could remember the details of jobs which had been done 20 or 30 years ago. A fair amount of castings was made on the grid bed, and there would be three sets of moulders discussing who should go on this work. The matter was settled amicably among themselves. So it would be appreciated there could be a lot of talking and planning going on among the foremen and the moulders with regard to a job after it had left the patternshop.

MR. HAYNES mentioned that he had congratulated a youth of about 18 years of age with respect to an intricate loam job he was working on for Mr. Hornby's firm. He seemed to be very much interested in it.

MR. ROLLITT said, with reference to Mr. Haynes' earlier remarks, that the head on the spindle was produced 20 years ago, but a cross-pin had never been combined with it.

Discussion—Loam Moulding

MR. LONGDEN thought that, with reference to strickling, they ought to remember that loam moulding was not used because of its convenience; it was practised very often because it was the safest way of getting castings.

Metal Composition

MR. VAN DER BEN noticed that in the evaporator body the total carbon content was stated as 3.3 and in the condenser body it was 3.5 per cent. Was that fortuitous or deliberate?

MR. HORNBY said that a carbon of between 3.3 and 3.5 was aimed at. In the two jobs the metal was melted in different cupolas, one in a 6-ton-per-hr. cupola and the other in a 9-ton-per-hr. cupola. The two instances quoted happened to be just at the extremes. The sulphur might have been a little high; it was the result of using coke which would not have been used in pre-war days. The manganese was kept on the high side to balance it.

MR. S. G. SMITH asked what were the man-hours spent on producing the evaporator body.

MR. HORNBY said the figure was about 870. On the second one, the condenser half shell, it was about 1,600. He had not the precise figures available.

MR. HORNBY said that, if a sand could be used for making a mould and produced no gases, permeability would not be required. There was then an analogy with a permanent mould; there was no mould permeability, but the casting was a good one. With ordinary moulding, however, the main thing was to make sure there was adequate venting for releasing gases. All knew there was no perfect sand; there were always some inherent gases present; in most cases, the gases were got clear away from the mould face, and then scabbing was prevented.

MR. E. LONGDEN said that another important point was that, with organic binders, the collapsibility of the sand after casting was increased.

Vote of Thanks

MR. E. LONGDEN proposed that a hearty vote of thanks be accorded to Mr. Hornby for his extremely interesting and instructive Paper. He considered this account should be read before every branch of the Institute. The information contained would be of special value to apprentices, because it covered such a wide field and offered great scope for the study of craftsmanship.

MR. H. STONE seconded the vote of thanks, which was carried unanimously by acclamation, and MR. HORNBY briefly responded.

The pattern of the macro grain size indicated that densification penetration up the bar was most effectively produced by cast iron, then by aluminium, copper, and magnesium in that order. Magnesium besides being least effective, was also the only one which showed slight pitting of the chill face due to burning.

The resistance to molten aluminium of aluminium chills was further evaluated by inserting some in the runner of a mould of fair size; after filling the mould and riser system, the chills over which all the metal in the mould had flowed were seen to be unaffected.—Yours, etc.,

A. E. CARTWRIGHT,*
Montreal, Canada. Metallurgist,
January 26, 1950. Crane, Limited,

* The writer was the Author of the Review of the Foundry Industry in Canada published in the JOURNAL, January, 1939, and co-author of the A.F.A. Exchange Paper to the Institute of British Foundrymen in 1940.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ALUMINIUM CHILLS FOR LIGHT-ALLOY CASTINGS

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—Among the many interesting and informative Papers that make profitable the reading of your JOURNAL, the Paper and discussion on "Casting a Large Pulley in Aluminium Alloy," by Wilson & Talbot was, in the writer's opinion, an outstanding one.

Relative to the technique used for chilling this casting and the discussion it aroused, it might be of interest and use to your readers to point out the superior qualities of aluminium itself as a chilling medium for light alloys. The foundryman is apt to overlook or dismiss the idea of this use for aluminium owing to its rela tively low melting point, forgetting that its resistance to molten aluminium alloys is at least equal to the resistance of cast-iron chills to molten cast iron in the production of chilled-iron castings.

The writer has previously discussed this subject in an article published in the American journal "Aluminium and Magnesium," Vol. 2, No. 3, December, 1945, but this may not have been seen by many of your readers; so, if your space will allow, the following few remarks on the subject may be helpful.

A consideration of the physical properties of high thermal conductivity, high latent heat of fusion and high specific heat of aluminium indicates a preferred position for it as a chilling medium. Anyone who has studied the melting economics for aluminium must have been impressed by the large number of B.T.U.s that it will absorb before melting. This liability in fuel economy becomes an asset where absorption of heat is referred to chilling technique.

Then, consider that plain and contour chills are quickly produced right in the light-alloy foundry. This can make a substantial difference to speed of delivery of castings when the organisation does not include an iron or brass foundry and chills have to be ordered outside with uncertain delivery of them holding up production. Aluminium chills are, of course, much more easily machined or file-finished than heavy-metal chills. They may be remelted and re-cast to other shapes, whereas heavy-metal chills are frequently just so much waste material once the job for which they were designed is completed. Aluminium chills, owing to their light weight, are much easier to hold in a green-sand mould, especially where it is necessary to set them in an overhang position. The same advantage applies to the carrying of chills in cores of low green strength.

The cheapest grade of scrap aluminium is adequate for producing chills and is, indeed, preferable if the chills are to contain anchoring nails or wires and the remelting of them will lead to iron contamination. This will not matter where low-grade aluminium is maintained for repeated re-casting of chills.

The use of aluminium chills was developed and practiced extensively by the writer during the late war in the production of aircraft castings in aluminium and magnesium alloys. A fairly quantitative measurement of the densifying power of various metals was made initially by the following simple method:—

Using the well-known standard D.T.D. test-bar mould, one in. long by $\frac{1}{16}$-in. dia. cylinders of cast iron, copper, aluminium alloy and magnesium alloy were placed, one each, in the bottom of four moulds and the moulds filled with aluminium-4 per cent. copper alloy at uniform pouring temperature. The four bars were half-sectioned longitudinally, polished and macro-etched.

(*Continued at foot of previous column.*)

The Institute of British Foundrymen

Election of New Members

At a meeting of the Council of the Institute of British Foundrymen, held at the Royal Station Hotel, York, on January 21, the following were elected to the various grades of membership:—

FIRST LIST

As Subscribing Firm Member

Joseph Berry, Limited, Albion Foundry, Swinton, Lancs. (Representative: W. S. Spenceley.)

Members

K. J. Bostridge, director, Halycon Products, Limited, London.

W. Brandt, foundry manager, Trianco, Limited, Molesey, Surrey; A. N. Chatterjee, chief engineer, Motor & Machinery Manufacturers, Limited, Calcutta; J. T. Clark, director, Halycon Products, Limited, London; J. F. Clatworthy, assistant foundry foreman, Western Foundries, Southall, Middlesex; E. Clegg, works manager and director, Lupton & Place, Limited, Burnley; W. L. Cunliffe, general manager, Jas. C. Cunliffe, Salford, 7; W. J. Hares,* master patternmaker, W. J. Hares, Fishponds, Bristol; E. Lupton, B.Sc.(Eng.), production manager, Tweedales & Smalley (1920), Limited, Rochdale; A. Pearson,* foundry manager, Bristol Diecasting Company.

As Associate Members

A. E. Bell, technical representative, Distington Engineering Company, Limited, Workington; A. K. Bhattacharya, general supervisor, Saxby & Farmer, Limited, Calcutta; C. B. Bolton, chief draughtsman, African Malleable Foundries, Limited, Benoni; M. N. Boyde, sales manager, Harborough Construction Company, Limited, Market Harborough; A. H. Clark, foundry foreman, North Eastern Marine Engineering Company, Limited, Wallsend-on-Tyne; R. Dransfield, foundry foreman, North Foundries, Limited, Monton Green, Eccles; T. W. Edge, assistant foreman, W. Shaw & Company, Limited, Middlesbrough; J. Fletcher, foreman coremaker, C. & B. Smith, Limited, Wolverhampton; R. N. Gandhi, student, National Foundry College, Wolverhampton; W. G. Garratt, foundry foreman, S. Russell & Sons, Limited, Leicester; A. Harwood, chargehand moulder, Gresham & Craven, Limited, Salford; C. G. Hendy, works manager, Bristol Diecasting Company; R. W. Henshaw, moulder, Stanton Ironworks Company, Limited; John Hodd,* under-foreman, Head Wrightson & Company, Limited, Thornaby-on-Tees; J. Hoyes, foreman moulder, Metropolitan-Vickers Electrical Company, Limited, Manchester; E. L. Huggins, foreman coremaker, Sheepbridge Stokes Centrifugal Castings Company, Limited, Chesterfield; S. D. Joshi, B.Sc.(Hons.), student trainee, Steels Engineering Products, Limited, Sunderland; R. Kirby, foundry foreman, Richardsons Westgarth & Company, Limited, Hartlepool; W. Lewins, foreman moulder, Charles W. Taylor & Sons, Limited, South Shields; D. M. Lewis, B.Sc.(Met.), research metallurgist, British Iron and Steel Research Association, London; W. Moulding, assistant manager, Greenside Foundry Company, Limited, Sheffield; A. A. McAdam, manager, St. Peters Foundry Company, Limited, Newcastle-upon-Tyne; W. J. Pollock, foundry metallurgist, Mather & Platt, Limited, Manchester; J. R. Richardson, foundry foreman, North Eastern Marine Engineering Company, Limited, Wallsend-on-Tyne; D. Sahai, foreman, Ordnance Factory, Ishapore, India; C. Satyamurty, works metallurgist, Textile Machinery Corporation, Limited, Belghurriah, W. Bengal, India; J. W. Sivyer, foundry metallurgist, Dorman, Long & Company, Limited, Middlesbrough; E. A. Skinner, works manager's assistant, Imperial Foundry, Ford Motor Company, Limited, Leamington; H. Stribblehill, patternmaker, Dartmouth Auto Castings, Limited, Smethwick; J. H. Taylor, foundry engineer, Ferranti, Limited, Hollinwood, Lancs; D. C. Verma, staff trainee, Darwins, Limited, Sheffield; J. H. Williams, casting inspector, Holman Bros., Limited, Camborne; J. Yarwood, foundry service engineer, Ferranti, Limited.

As Associates (over 21)

W. A. Adie, moulder, C. A. Parsons & Company, Limited, Newcastle-upon-Tyne; H. Bell, moulder, Jarrow Metal Industries Limited, Jarrow-on-Tyne; G. Blythe, moulder, James Hodgkinson (Salford), Limited, Salford; R. W. Currie, patternmaker, William Mills, Limited, Wednesbury; N. Gibson, student, King's College, Newcastle-upon-Tyne; R. T. Hinds, foundry foreman, Erewash Foundry, Stanton Ironworks Company, Limited; J. Rigby, moulder, Ircast Foundries, Limited, Whitworth, Lancs.; A. A. Rodda, patternmaker, William Mills, Limited; J. Tate, coremaker, J. H. Ritson & Son, Limited, Gateshead; J. E. R. Tompkin, foundry metallurgy student, University of Sheffield; H. Varney, pattern moulder, Park Foundry (Belper), Limited, Belper.

As Associates (under 21)

C. J. Appleton, apprentice patternmaker, James & Ronald Ritchie, Limited, Middlesbrough; R. Armstrong, patternmaker, Smith's Dock Company, Limited, Middlesbrough; W. Amos, metallurgical assistant, Qualcast, Limited, Derby; E. Bean, apprentice patternmaker, Cargo Fleet Iron Company, Limited, Middlesbrough; J. Buckle, patternmaker, Head Wrightson & Company, Limited, Thornaby-on-Tees; N. D. Cail, apprentice patternmaker, Cargo Fleet Iron Company, Limited; K. Dilworth, apprentice patternmaker, Charles P. Kinnell & Company, Limited, Vulcan Iron Works, Middlesbrough; P. F. Ellis, apprentice metallurgical chemist, North Eastern Marine Engineering Company, Limited, Wallsend-on-Tyne; T. E. Peacock, apprentice metallurgical chemist, Swann Hunter & Wigham Richardson, Limited, Walker-on-Tyne; G. D. Potts, apprentice patternmaker, C. & B. Smith, Limited, Wolverhampton; G. M. Wood, student apprentice, Stewart and Lloyds, Limited, Bilston.

SECOND LIST

As Subscribing Firm Members

Lupton & Place, Limited, Burnley, aluminium alloy, iron and brass founders and machinists. (Representative: E. Clegg). Robert Taylor & Company (Ironfounders), Limited, Larbert, Stirlingshire. (Representative: R. Taylor).

* Transferred

Election of New Members

As Members

W. Collinge,* foundry works manager, Newman Industries, Limited, Bristol; R. F. Davis, foundry manager, Langley Alloys, Limited; A. Flower, proprietor, Caledonian Engineering Company, Newton-le-Willows; S. Francis, managing director, Brontalloy, Limited, Drighlington, Bradford; C. N. Hale, chief ironfoundry foreman, Railway Executive Eastern Region, Gorton; T. W. I. Harris, chief metallurgist, Blakey's Boot Protectors, Limited, Leeds; L. Heinemann, chief draughtsman, Barratt & Pillans, Limited, Luipaardsvlei, South Africa; E. Jackson,* proprietor, E. Jackson & Company, Limited, Manchester; D. E. Krause, executive director, Gray Iron Research Institute, Inc., Columbus, Ohio, U.S.A.; F. Lea, partner, Hawthorne & Lea, Bradford; J. S. Mackie, proprietor, A. McArthur & Son, Aberdeen; T. A. Purvis,* chargehand patternmaker, Consett Iron Company, Limited; M. M. Stubbs,* director, John M. Rodger & Son, Limited, Ayr; R. Taylor, chairman and managing director, R. Taylor (Ironfounders), Limited, Larbert; G. Ward,* director and manager, Crawcast, Limited, Rochdale.

As Associate Members

D. H. Armitage, foundry superintendent, aircraft steelfoundry, David Brown Foundries Company, Penistone; L. R. Barnes, foreman moulder, Walker & Smith, Limited, Batley; J. H. Boyle, plant engineer, Lane & Girvan, Limited, Bonnybridge; J. Cameron, foreman moulder, Carntyne Steel Castings, Limited, Renfrew; S. Clark, patternmaker, Noble & Lund, Limited, Felling-on-Tyne; P. D. Curley, director, Storey Foundry Company, Limited, Stockport; B. Dunn, chargehand moulder, S. Russell & Sons, Limited, Leicester; T. Harding, foreman moulder, Cochranes (Middlesbrough) Foundry, Limited; G. J. T. Harris, foreman patternmaker, Richard Thomas & Baldwins, Limited, Swansea; G. E. Hawthorne, partner, Hawthorne & Lea, Bradford; W. H. Hay, foundry technical development engineer, Singer Manufacturing Company, Limited, Clydebank; G. Higgins, foreman moulder, Tweedales & Smalley (1920), Limited, Rochdale; J. Hughes, foundry superintendent, Brookhirst Switchgear, Limited, Chester; J. P. Macnab, foundry plant foreman, Thomas Allan & Sons, Limited, Thornaby-on-Tees; J. McDermick, patternmaker, Walter McFarlane & Company, Limited, Glasgow; A. W. McFarlane, foundry foreman, Morrison, Ingram & Company, Limited, Manchester; R. McLachlan, foreman moulder, Cameron & Roberton, Limited, Kirkintilloch; W. Nash, leading moulder, David Brown-Jackson, Limited, Salford; W. Niven, assistant foreman patternmaker, R. Taylor (Ironfounders), Limited; F. F. Rennie, assistant metallurgist, Ferranti, Limited; J. I. Stirling, foundry works manager, Southern Foundries (1926), Limited, Croydon; H. B. Wight, chief metallurgist, Harland Engineering Company, Limited, Alloa.

As Associates (*over* 21)

G. Cesana, managing director, S. A. Cesana, Milan, Italy; A. N. Davis, student, foundry practice, Babcock & Wilcox, Limited, Renfrew; C. J. Elliott, patternmaker, Head Wrightson & Company, Limited, Thornaby-on-Tees; D. Forster, apprentice, Darlington Forge, Limited; J. N. Heighley, patternmaker, Head, Wrightson & Company, Limited; J. Noble, patternmaker, Tees Side Bridge Engineering Works, Limited, Middlesbrough; D. Walker, patternmaker, British Railways, Cowlairs.

* Transferred

As Associates (*under* 21)

J. F. Aldersley, foundry apprentice, J. Blakeborough & Sons, Limited, Brighouse; E. G. Ellis, apprentice patternmaker, W. Shaw & Company, Limited, Middlesbrough; J. J. Danby, apprentice patternmaker, Imeson & Finch, Limited, Stockton-on-Tees; S. R. Goodchild, apprentice patternmaker, Dorman, Long & Company, Limited, Middlesbrough; C. Gorman, apprentice patternmaker, Skinningrove Iron & Steel Company, Limited; G. R. Hauxwell, apprentice moulder, Blackett & Hutton, Limited, Guisborough; R. F. Lawson, apprentice moulder, Cochrane's (Middlesbrough), Limited; S. E. Lobb, apprentice patternmaker, Imeson & Finch, Limited, C. R. Mackinlay, apprentice patternmaker, Head Wrightson, Limited, Stockton-on-Tees; R. S. Methven, foundry technician, Qualcast, Limited, Derby; J. McCluskey, apprentice patternmaker, Head Wrightson & Company, Limited; J. McLaren, apprentice patternmaker, Head Wrightson & Company, Limited; R. McRobert, apprentice patternmaker, Head Wrightson & Company, Limited; R. A. Payne, junior draughtsman, Barratt & Pillows, Limited, Luipaardsvlei, South Africa; B. Porter, apprentice, Qualcast, Limited; P. Richardson, apprentice patternmaker, Cochrane & Company, Limited; W. D. Ritchings, apprentice patternmaker, Dorman, Long & Company, Limited; C. Robinson, apprentice patternmaker, Blackett Hutton & Company, Limited, Guisborough; E. G. Rowland, apprentice moulder, Blackett Hutton Company, Limited; D. Stoddard, apprentice patternmaker, Dorman, Long & Company, Limited.

THIRD LIST

As Members

W. H. Hornby,* foundry manager, G. & J. Weir, Limited, Glasgow; R. Taylor, chief designer, Paterson Hughes Engineering Company, Lim .ed, Glasgow.

As Associate Member

A. Grassam, foreman moulder, M. Cockburn & Company, Limited, Falkirk.

As Associate (*over* 21)

S. S. Mullock, metallurgical assistant, United Provinces Government Workshop, Roorkee, India.

Gating Systems.

(*Continued from page* 118.)

drying stove. The difference in permeabilities on the bottom and mid-section was that there being very little surface area on the mid-section, it did not require a high permeability, as the liberty had been taken of introducing more clay, this reducing permeability and increasing the cohesiveness or green strength to ensure better draws, thereby saving time. He did not care for the notion of blocking out. Regarding productivity, the excellent production was such that he thought that if some of the leading machine-tool makers would apply this method on various machine-tool bodies he was convinced that it would save them much money. The mould box dimensions were approximately inside 6 ft. by 3 ft. 6 ins., and three men produced nine per week. If blocked out it would take twice as long to produce that quantity. Mr. Collinge said taking the wall section ¾ in. and the weight approximately 14 cwts., he could say emphatically that it was a really good job.

MR. ROBERTSON proposed, and MR. POTTS seconded, a vote of thanks to Mr. Collinge for an admirable Paper, and the members endorsed the proposal with acclamation.

De-enamelling

By Bernard B. Kent

The substantially increased post-war cost of fabricated components which are to be vitreous enamelled has focused attention upon the economies to be secured by efficient de-enamelling of defective items as a means of salvage. The Author, who is one of the pioneers in this country of commercial de-enamelling, has reviewed the various methods available and has critically examined the merits and de-merits of each in the light of his personal experience. The Paper was presented at the January meeting of the Southern Section of the Institute of Vitreous Enamellers.

ALTHOUGH the art of enamelling dates back to some 4000 years B.C., de-enamelling only appears to have been practised during the last twenty or thirty years and it must be presumed that the Chinese craftsman in ancient days, on finding that his masterpiece was spoilt, had no alternative but to discard it.

Plants for de-enamelling by the caustic-solution method have been in operation for the better part of the last quarter of a century but it was not until about 1932 that the first "molten" plant was put down by the Americans. In 1934, the writer visited this plant in the United States and as a result, built and operated in 1936, the first "molten" plant in this country, and at the same time obtained a British patent for the process.

Cost of Metal for Enamelling

Owing to the present steel shortage, the de-enamelling of enamelled components has become of great importance in the industry. Whereas in normal times only intricate parts, upon which much labour has been expended, are worth de-enamelling, to-day even flat plates and such simply-made articles as table tops must be stripped in order to salvage the steel. Further, because much of the steel supplied at the present time for enamelling is not in reality suitable for the purpose, a high percentage of scrap results and more components have to be de-enamelled. Additionally, the high quality of enamelware demanded by the consumers since the war necessitates the scrapping of many parts which hitherto would have been accepted. Even one small spot on a cooker part will now cause the part to be rejected. It is interesting to note that when components are de-enamelled by the molten caustic process they usually re-enamel perfectly, no doubt due to the fact that immersion in the fused caustic normalises the steel and removes impurities.

Methods Available

De-enamelling may be effected in several ways:—by sand-blasting, by immersion in molten caustic, in caustic soda solution, in hydrofluoric acid or even in other acids. By far the simplest and easiest method is by shot-blasting, but this method is only suitable for castings and steel sheets thicker than 16 gauge. Whilst castings present no difficulty, except that extra care is required in blasting, a special technique has to be used when re-enamelling sheet steel de-enamelled by the shot-blasting method, of which details will be given later.

De-enamelling by hydrofluoric acid is effective but not altogether satisfactory, as this acid attacks almost all vessels in which it is stored and used. In any case, the process is dangerous and the cost is considerably higher than when other methods are employed. The one advantage is that this acid solution can be used cold. Enamel can also be removed by hydrofluoric and sulphuric acids, but this method is slow and only removes soft enamels and ground coat, whilst, if the component is not removed from the solution immediately de-enamelling is completed, the base metal will be attacked.

Use of Caustic Soda

The best means so far known of removing enamel is by caustic soda either in solution or in the fused state. Both methods are equally effective and each has its advantages and disadvantages. In respect of cost, the "molten" process is more expensive, requires more expensive and elaborate equipment and greater skill and care in operation. For flat articles such as cooker crown plates, table tops, splash backs, refrigerator door panels, etc., the solution method is probably the better, as large quantities can be packed into the de-enamelling tank and at the moderate temperature of 140 deg. F. distortion or buckling is unlikely to occur. For other items, such as refrigerator liners, geyser cases and one-piece oven interiors, the solution method of de-enamelling is not practicable owing to the bulk of the components as, unless the tank is of exceptionally large size, it is only possible to heat about half a dozen items at one time, with the result that the throughput is as low as one liner per hour. With the "molten" method, liners can be stripped completely in a few minutes and a throughput of about twenty per hour obtained. Unless, however, sufficient work is available to keep this type of plant completely occupied, it is not an economic proposition, as to operate the equipment efficiently the caustic must never be allowed to solidify.

Plant Using Molten Caustic

A molten caustic plant consists of a mild-steel tank (Fig. 1), say, 6 by 4 by 5 ft., fabricated from one-in. thick plate, with all seams electrically welded and pre-

De-enamelling

ferably normalised after fabrication. This tank may be heated by electricity or by gas but, in the writer's experience, gas is cheaper and, if the plant is suitably designed for gas firing, the life of the tank is at least two to three years. Taking into account the lower cost of operation and the replacement of the tank,

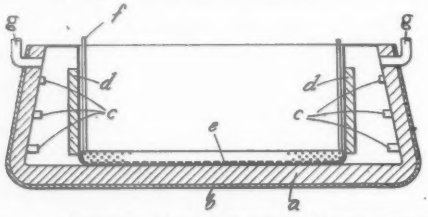


FIG. 1.—SECTIONAL VIEW THROUGH A DE-ENAMELLING TANK EMPLOYING MOLTEN CAUSTIC.

(*a*) Firebrick lining. (*d*) Firebrick baffle.
(*b*) Outer casing. (*e*) Sludge tray.
(*c*) Bunsen burners. (*f*) Sludge-tray yoke.
(*g*) Flue.

say, every two years, the cost is still less than of electrically heating the tank, though this would (in theory) then last indefinitely.

A suitable method of heating the tank by gas is to utilise six Bunsen-type burners, Fig. 1 (*c*), three each side, protecting the tank from the direct flame by building a firebrick baffle (*d*) inside the combustion chamber. The products of combustion pass round the outside of the tank and are led to the waste stack by a flue (*g*), each end leading into a single flue which is carried through the roof of the building. It will probably be found necessary, however, to fit a cowl to this stack to stop down-draft on windy days.

Electrical Heating

If the tank is to be heated electrically, it can be done either by immersion heaters or by electrodes. Both means are effective but their disadvantage is that the immersion heaters or electrodes occupy a portion of the tank which could otherwise be utilised for de-enamelling. Also, the sludge tray (Fig. 2) has to be smaller by several inches than the actual area of the bottom of the tank and this smaller tray means that a percentage of the falling enamel drops outside the tray on to the bottom of the heaters, thereby nullifying some of their efficiency and making it necessary for the tank to be emptied periodically in order that the solidified sludge may be chipped away.

It is also necessary to pay more attention to the lagging of an electrically-heated tank and to fit an insulated lid. This in turn slows down the cooling operation prior to de-sludging and it has been found that, whereas a gas-heated tank drops in temperature from 480 to 380 deg. C. in three to four hours, an electrically-heated tank takes something like seven hours. The heating of the tank from cold also is appreciably slower. In the writer's experience the cost of heating a de-enamelling tank by electricity is nearly double that when gas is used.

Control and Operational Details

The temperature of the molten-caustic tank should be regulated by automatic equipment and the thermo-couple protected by a nickel-steel tube immersed in the caustic. A sludge tray, Fig. 2, should rest on the bottom of the tank. This item consists of a perforated metal tray, approximately 4 in. deep, arranged to cover the entire bottom surface of the tank. To this tray lifting lugs are fixed. A minimum of two of these trays is required, and three are advisable.

Over the tank, an electric hoist must be fitted to be used both for immersing work and for putting in and withdrawing the sludge tray. This overhead crane, as a safety measure, must be operated by remote control. On the front of the tank a screen of wired plate glass should be mounted to guard against splashes of caustic soda due to mishap or the accidental immersion of wet work.

When starting up the plant, the perforated sludge-tray is placed at the bottom of the tank and the appropriate number of barrels of flake caustic soda is added until the tank is filled. The heat is then applied and after three to four hours the caustic will begin to melt and settle. Further barrels of caustic are then added until the level of the fused caustic is about six inches from the top of the tank. The temperature of the caustic will then be about 480 deg. C. and must be maintained at about this figure, because, if a temperature of 500 deg. C. is exceeded, erosion of the tank may occur and there is the risk of distortion of the tank and of the items being treated.

The equipment is now ready for working and a batch of work for de-enamelling is introduced contained in a cradle hung from the electric hoist. Great care must be taken to ensure that all components are thoroughly dried before immersion, otherwise an explosion will take place. The work placed in the cradle must be selected and arranged so that the molten caustic can come into direct contact with all surfaces. For example, it is useless to place a number of flat plates together or to allow one article to rest on top of another. The best way is to arrange an assorted load of various shapes and sizes .

Normal Working Schedule

For the first few hours of operation, the enamel should be stripped in from two to six minutes, but the process slows down and, after approximately five

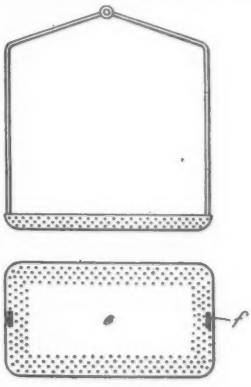


FIG. 2.—SLUDGE TRAY (PLAN AND ELEVATION) FOR THE DE-ENAMELLING TANK SHOWN IN FIG. 1.

hours of continuous working, articles may take as long fifteen minutes to strip. Eventually, it would be found impossible to strip the components at all. In practice, the most difficult articles, such as those with several coats of acid-resisting enamel, are immersed first and ground-coat finishes later, when the molten soda is

not working as efficiently. It is not worth-while operating the tank when a ground-coated item takes longer than six to eight minutes to strip. At such a condition for the tank, the heat is then turned off and the temperature allowed to drop 100 deg. C. At this lower temperature, the caustic is still in the molten state and the waste enamel and compound impurities collect in the sludge tray. The heat is then re-applied to the tank once more and the temperature is brought back to 480 deg. C.

At any time during this period the tank may be topped-up with further supplies of flake caustic and it is immaterial whether this is added at the end of the de-enamelling period or when the temperature is again being brought up to working heat. The sludge tray is then removed and will be found to contain three to four inches deep of solids. A fresh tray is then introduced and the tank is again ready for operation.

De-sludging

It will be found in actual practice that after about 10 days working it may be necessary to de-sludge twice, that is, reduce the temperature by 100 deg. C., increase to normal, remove the sludge tray, put in a further tray, reduce the temperature again and once more bring back to normal operating temperature.

The sludge is removed from the sludge tray by mechanical means and, as it is found upon analysis to contain approximately 75 per cent. of caustic, it may be broken up and used in the caustic-solution tanks. Although this sludge may not materially increase the efficiency of the solution tanks, it is a means of disposal of a product which, unless buried, is dangerous. In 1939, a batch of sludge was deposited in the factory yard, and, when the tank was again started up after the war ended—six years later, this sludge was found to contain approximately the original amount of caustic and was actually used for solution de-enamelling.

In an American patent, the idea was put forward for introducing superheated steam into the molten caustic at the end of the de-enamellinng period, as it was claimed that the sludge was thereby considerably reduced and the caustic soda cleaned. The Author understands that the only experiments of this nature conducted in England were undertaken by the Parkinson Stove Company in 1937 in which trials he was himself associated, but the practice was discontinued after a short time.

Caustic Solution De-enamelling

Dealing now with the solution method, which is the one in more general use, the equipment for this is much simpler than for the "molten" method and a tank constructed of ¼-in. plate will be found to be satisfactory, provided the seams are carefully welded. Preferably, a piece of angle iron should be welded on the inside of the tank in order to give a double weld. A tank can of course be of any size but if it too large and springs a leak during a period of working, the loss of caustic will be a serious factor. A most useful size of tank is one containing about 600 gallons of solution. The solution tank, also, may be heated by means of electricity or gas. The gas heating may be accomplished by a series of burners under the tank, with suitable lagging, and the waste gases may be led round between the lagging and the tank or, alternatively, heat may be obtained by burning the gas in tubes running through the tank. The latter is probably the more efficient method.

Making-up the Bath

When making-up the solution of caustic soda, great care must be taken to ensure that the concentration does not exceed 50 per cent., because, if more than equal weights of caustic soda and water are used, the de-enamelling operation is slowed down, whilst if the concentration is taken up to 65 per cent., it will be found that it is impossible to de-enamel at all. The exact capacity of the tank having been calculated, it is filled with water and the correct amount of caustic soda is introduced by means of a tray. It will be noticed that when the caustic dissolves in the water considerable heat is produced. At the end of this operation, the gas burners are lit (or the current is turned on) and the temperature is brought up to just below boiling point, that is, about 140 deg. C. If insufficient caustic has been added to the water, the liquid will boil at a lower temperature and careful observation of the temperature at which the solution boils is a very effective method of checking its strength. A check of the strength of the solution should be made at least once every day while the bath is in use.

Working the Solution Process

It will be found that enamelware can be de-enamelled in from five to fourteen hours, this big variation being due to such factors as the thickness and make and type of enamel. Naturally, an acid-resisting enamel takes longer to strip than, say, a ground coat. If the tank is worked continuously, that is, a new load of work is immersed approximately every 12 hours, the solution will remain active for about three weeks and it should only be necessary to top-up with water two or three times a day to take care of evaporation. In practice, however, an additional quantity of caustic must be added after approximately 10 days to replace that removed mechanically with the components after treatment.

When the tank is worked out, the solution is allowed to settle for two of three hours and the clear liquor is then removed to a tank of similar size by means of a pump or syphon. When the tank is empty, the sludge on the bottom of the tank, which will be four to six inches deep, is dug out and discarded. A sludge tray may of course be used but is not really necessary; if a tray is used, the cradle containing the work would have to be smaller, with consequent loss of working space in the tank. Next, the clear liquor is returned to the tank, topped up with fresh water and the requisite quantity of raw caustic is added. By utilising the clear liquor, a saving of raw caustic can be effected, but the strength of the solution should be carefully adjusted so that the liquid boils at 140 deg. C.

Subsequent Treatment

Whichever method has been used to remove the enamel, it is necessary subsequently to remove the caustic from the components and this is probably the most difficult part of the operation. Components de-enamelled by the "molten" method are best left immersed for at least six hours in water prior to washing off, but articles de-enamelled by the solution method can be scrubbed clean at once in running water with either wire brushes, wire wool or rag. If sufficient waste heat is available in the plant to produce warm water, this is more effective, but it makes it too expensive a luxury if the water has to be heated especially for the purpose.

Re-enamelling

After washing to remove as much as possible of the caustic the components are ready for the re-enamelling process. If possible, a separate acid tank should be provided for pickling parts which have been de-enamelled and, whilst it is probably sufficient for ordinary enamelling practice to use a 10 per cent.

De-enamelling

solution of cold hydrochloric acid, it is essential to use a 20 per cent. solution for de-enamelled articles. It has been discovered, however, that if de-enamelled parts can be stored in the open for a few days, especially in damp weather, any traces of caustic are converted to carbonate, which can be removed in a normal pickling solution.

It occasionally happens that when a component has been given several coats of enamel, especially of the acid-resisting variety, it is difficult to remove and needs double or even treble de-enamelling treatment and this is, of course, uneconomic, especially with the "molten" process, as it is imperative that components are washed between each immersion, *i.e.*, if a component still has patches of enamel when withdrawn from the tank, it is not possible to re-immerse without first washing. Small patches of enamel can, however, be removed by light shot-blasting, provided that a very fine angular grit is used and the pressure is kept below say 25 lb. per sq. in. When all traces of grit are removed, items can be enamelled in the usual way although it may be advisable to apply the ground coat rather thicker than normal. De-enamelled parts enamel quite as well as new articles and in fact, as already mentioned, rejects due to poor quality iron are negligible when they are re-enamelled subsequent to the de-enamelling process.

The Vitreous Enamellers' Association have recently published a pamphlet on "Design for Vitreous Enamelling" which shows a number of designs of work which cannot be satisfactorily enamelled. These articles cannot either be satisfactorily de-enamelled, especially where there are enclosed spaces, tightly folded ends and folded joints. Caustic will enter these (virtually) closed spaces and cannot be removed by pickling or even by "grease burning," with the result that, when the component is being re-enamelled, the caustic boils through during fusion. Also, if articles with enclosed spaces are introduced into the fused caustic and water or other liquid has been trapped in these spaces, an explosion will occur.

Conclusion

In conclusion, the caustic process is quite a satisfactory one for de-enamelling but great care must be taken at all times in the handling of the caustic soda. The molten soda will cause very severe burns if splashed on the skin and even the soda in the solution will cause a painful burn. Operators must at all times be given suitable protective clothing, such as rubber gauntlets, goggles, rubber aprons and boots and a supply of sal-ammoniac solution should be kept at hand in case of accident. It is also advisable to have a vat of cold water available for speedy immersion of any part of the body which, in spite of these precautions, is splashed.

Besides enamelware, caustic soda will, of course, attack almost everything else with which it comes in contact and all equipment, gas burners, pyrometers, hoists and temperature-controlling gear must be frequently cleaned, and, if possible, protected.

TO CELEBRATE its jubilee, the British Ceramic Society, which was founded in 1900, is arranging to hold a convention in Stoke-on-Trent and Buxton on Tuesday, Wednesday and Thursday, April 25 to 27. The programme will include Papers and works visits of interest to all sections of the Society, besides a jubilee dinner and other functions.

Molybdenum in Vitreous Enamels

*By Karl Kautz**

Molybdenum compounds are used in vitreous enamels in three ways, *viz.*, (1) as surface-tension reducers, (2) as adherence-promoting agents, and (3) as opacifiers. Small amounts of molybdenum compounds smelted into vitreous-enamel compositions (also glasses and glazes) reduce surface tension. This, in turn, often increases the wetting action or "wettability" of the glassy material in contact with other materials. For this purpose 0.15 to 0.20 per cent. of the molybdenum material has been found sufficient in most cases.

Molybdenum compounds in larger amounts in vitreous-enamel compositions tend to promote adherence of enamel coatings to base metals. This effect is enhanced when antimony compounds are present. For promoting adherence, molybdenum compounds may be used in two ways:—(*a*) as mill additions, and (*b*) as smelting additions. Additions of 1 to 2 per cent. barium molybdate with ½ to 1 per cent. antimony oxide to the mill batch of an enamel frit produces an increase in the adhesion of the coating to base metals. This effect is greatest in clear frits and antimony-bearing frits and is found to a lesser extent in zircon-bearing and titania-bearing frits.

Clear, or grey-coloured enamels, with excellent adherence to sheet steel or cast iron, may be made by smelting into the batch from 1 to 1½ per cent. molybdic oxide and from 1 to 4 per cent antimony oxide. Such enamels, maturing in the 700 to 730 deg. C. range, are in commercial use in the United States to-day for the production of single-fire pastel-coloured coats. These coats are not acid-resistant, but make excellent coatings for interior architectural panels when applied to ordinary sheet steel with or without a nickel-flash treatment. This type of enamel also makes an excellent white ground coat at 700 to 730 deg. C. High-opacity zircon-containing cover coats, or acid-resisting antimony-containing cover coats may be applied as a second coat over these white ground-coats at 700 to 730 deg. C. to give thin high-quality finishes.

Another use of molybdenum compounds in vitreous enamels, besides those mentioned, is for producing opacity or augmenting the opacity produced by antimony. For this purpose 4 to 7 per cent. molybdic oxide is smelted into the vitreous-enamel composition. The opacity of some acid-resisting antimony-containing enamels is greatly increased by this method. Molybdic oxide in large amounts does not seem to have much effect in white zircon-containing enamels and acts as a discolourant in the white titanium-containing enamels now in use. One-coat, single-fire, non-acid-resisting white enamels maturing at 700 to 730 deg. C. can easily be made by smelting the proper amounts of antimony and molybdic oxide in special frits. These white enamels may be applied to ordinary sheet steels with or without nickel flashing to produce white coats by single firing.

Publication Received

Design for Vitreous Enamelling.—The Vitreous Enamellers' Association, of 24, Waterloo Street, Birmingham, with the co-operation of the Council of Industrial Design, have published a six-page booklet which by means of sketches and letterpress shows exactly "what to avoid," "what to adopt," and "always to do" when designing components of either castings or sheet metal for subsequent vitreous enamelling. It can be characterised by the dual appellations of sensible and simple and therefore should have the widest appeal.

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* The Author is Ceramics Engineer, Climax Molybdenum Co., U.S.A.

Vitreous Enamelling of Light-alloy Castings

Present Position and Potential Scope

The rapid expansion of the light-alloy foundry industry has directed attention towards the development of enamels suitable for the vitreous enamelling of aluminium and aluminium alloys. Experimental enamels of low fusion point have been tested in the laboratories of the British Non-ferrous Metals Research Association. Though the development of suitable enamels is still in its early stages, tests have given very promising results. The preliminary findings are favourable, though accurate indications of behaviour in service can only be obtained by larger-scale tests and, ultimately, full-scale service trials.

In attempting to assess the practical significance of this development and the commercial scope for the vitreous enamelling of light alloys, a number of factors have to be taken into consideration. In the case of cast iron the foundryman starts off with a casting produced from a relatively cheap material. Vitreous enamelling enables him to supply an article of superior finish, improved colour and greater resistance to acids, corrosion, etc.

Initial Handicaps

The cost of an aluminium casting is usually rather higher than that of a cast-iron product. Thus, aluminium is unfavourably placed in regard to most of the applications for which cast iron is already well established, unless this initial advantage is offset by the weight factor or by some other special consideration. Another handicap at this stage is the cost of the enamelling process, which would be appreciably higher than that of treating a comparable casting in iron. Moreover, the process would offer little advantage unless the special qualities of the vitreous-enamel finish were superior to those of the actual casting. Vitreous enamels for aluminium and aluminium alloys are not so hard as those normally used on cast iron, but they do improve the resistance of the surface to mechanical damage. The type of application for which the process might commercially be useful is the vitreous enamelling of aluminium components of certain high-priced articles, where the cost of the enamelled casting represents only a small proportion of the total cost.

A Promising Field

A good example is provided by aluminium castings such as the wringers on modern washing machines, which are in constant contact with soapy, alkaline water. In the course of time the stove-enamel finish peels off and the surface of the aluminium casting itself is then subjected to the alkaline water, which gives it an unattractive greyish appearance. The cost of the casting is a relatively small item in the production of a complete washing machine, and a vitreous-enamelled surface would not suffer the same deterioration as a stove enamel.

Another important consideration is the need for a lead-free enamel. Not only are lead-bearing frits potentially dangerous to those who have to work with them, but there is also the possibility of lead contamination taking place with the contents of aluminium containers that have been vitreous enamelled. The frits must therefore be lead-free. This raises yet another problem. In developing a suitable enamel for light alloys, it is essential to obtain a material which has a melting point preferably of about 500 deg. C. Aluminium/silicon alloys have the highest eutectic melting points (about 585 deg. C.); those of aluminium/copper alloys are about 545 deg. C. Since most castings are of complex alloys, in which there are probably ternary constituents of lower melting points, an enamel is required which will fire satisfactorily between 500 and 520 deg. C. Those which have so far been developed tend to be rather above that level—about 550 deg. C. Again, a great deal of experience will have to be gained in the design of suitable castings for vitreous enamelling and also in the most suitable alloys to use.

Present Position

The position to-day is that enamels of low fusion-point for the vitreous enamelling of light-alloy products have been produced and tested on a laboratory scale with very small experimental runs. Until some industrialist has the interest and the capital to develop the process on a production scale, progress in this field during the next few years is not likely to be great, though the long-term potentialities should be considerable. At the outset the process is only likely to be used for what is generally termed the luxury type of article as opposed to the every-day, competitive casting. Eventually the costs of enamels should come down, and vitreous-enamel finishes for light-alloy castings may then be spread into a number of fields. In the production of gas-cooker burners, for instance, a certain company is using die-cast aluminium components. Vitreous enamelling would eliminate the necessity for such persistent cleaning and polishing to keep the burners bright. Wherever resistance to alkalis is required, vitreous-enamel finishes should give very good results, and the process might therefore be extended eventually to such articles as kitchen sinks. These developments would depend very largely on the question of costs.

The final decision must rest with the foundrymen themselves. If foundrymen decide that they require the process, it will obviously be further developed. Since they are supplementary to, rather than competitive with, cast iron, there should be a definite field for vitreous-enamelled light alloys. The aluminium industry is actively engaged in investigating the possibilities of this new development, and any new finishes put forward are submitted to various tests which are now becoming standardised. It is thus possible to assess a new finish with considerable accuracy even before full service trials are put in hand.

Dinner

Midland Section of the Institute of Vitreous Enamellers

Mr. J. Price presided over the annual dinner of the Midland Section of the Institute of Vitreous Enamellers held at the Market Hotel, Birmingham, on January 20. Some 60 members attended amongst whom were Dr. J. E. Hurst, Mr. A. E. Boulton (vice-chairman of the Midland Section of the Society of Glass Technology), Mr. H. Laithwaite, and Mr. H. K. Williams. The function was organised by Mr. D. Sleath.

STRESS-CORROSION tests on steels at elevated temperatures in caustic solution are reported upon by C. D. Weir, Ph.D., B.Sc., in a Paper on caustic cracking, presented to the Institution of Mechanical Engineers. It was found consistently that failure occurred with notched specimens but that homogeneously-stressed specimens were immune. This confirms the need for thorough stress-relief heat-treatment of fabricated tanks for holding caustic solutions, such as are used for de-enamelling and de-greasing.

British Blast Furnaces in the December Quarter, 1949

These tables are published through the courtesy of the British Iron and Steel Federation.

Derby, Leicester, Notts, Northants, and Essex.

Name of firm.	In blast, December 31, 1949, making :—				Weekly average in blast.		Total built.	Furnaces relining.
	Hematite.	Forge and foundry.	Basic.	Total.	Dec., 1949, quarter.	Sept., 1949, quarter.		
Clay Cross	—	1	—	1	1	1	2	—
Ford Motor	—	1	—	1	1	1	1	—
Holwell Iron	—	3	—	3	3	3	5	1
Kettering Iron & Coal	—	2	—	2	2	2	2	—
New Cransley Iron & Steel	—	1	—	1	1	1	2	1
Renishaw Iron	—	2	—	2	2	2	2	—
Sheepbridge	—	1	—	1	1	0·4	1	—
Stanton Ironworks : Stanton-by-Dale	—	5	—	5	5	5	5	—
Staveley Iron & Chemical	—	4	—	4	4	3·9	4	—
Stewarts and Lloyds : Corby	—	—	4	4	3·4	4	4	—
Wellingboro' Iron	—	—	2	2	2	2	3	1
Total	—	20	6	26	25·4	25·3	31	3

Lancashire (excl. N.-W. Coast), Denbigh, Flint, and Cheshire.

Brymbo Steel	—	—	1	1	1	1	1	—
Darwen & Mostyn	—	—	—	1*	1	1	1	—
Lancashire Steel Corp'n.	—	—	2	3†	3	3	4	1
Total	—	—	3	5	5	5	6	1

* Producing spiegeleisen. † Includes one producing ferro-manganese.

North-West Coast.

Barrow Ironworks	2	—	—	2	2	2	3	—
Charcoal Iron	—	1	—	1	1	0·6	1	—
Millom & Askam	2	—	—	2	2	2	3	1
United Steel: Workington	2	—	—	2	2	2	3	1
Total	6	1	—	7	7	6·6	10	2

Lincolnshire.

Appleby-Frodingham	—	—	9	9	8·8	8·8	9	—
Lysaght, J. : Scunthorpe	—	—	4	4	4	3·8	4	—
Thomas, R., & Baldwins : Redbourn	—	—	2	2	2	2	2	—
Total	—	—	15	15	14·8	14·6	15	—

North-East Coast.

Cargo Fleet Iron	—	—	2	2	2	2	2	—
Consett Iron	1	—	1	2	2	2	2	—
Dorman, Long : Acklam	—	—	3	3	3	3	4	1
Redcar	—	—	2	2	2	2	2	—
Cleveland	—	—	2	2	2	2	5	—
Bessemer	—	—	2	2	2	2	3	1
South Bank	—	—	—	2*	2	2	4	—
Grangetown	—	—	—	—	—	—	2	—
Gjers, Mills & Co.	2	—	—	2	2	2	5	—
Pease & Partners	2	—	—	2	2	2	3	1
Skinningrove Iron	—	—	2	2	2	2	2	—
South Durham Steel & Iron	—	—	2	2	2	2	3	—
Total	5	—	16	23	23	23	37	3

* Producing ferro-manganese.

Scotland.

Bairds & Scottish Steel : Gartcherrie	1	1	1	3	3	3	5	1
Carron	—	1	—	1	1	1	4	1
Colvilles	—	—	3	3	3	3	3	—
Dixon's	—	1	—	1	1·7	2	6	1
Total	1	3	4	8	8·7	9	18	3

Income-tax Assessment

Divergent Opinions on Methods

A considerable divergence of opinion on the basis of assessment of income tax was revealed to the Committee on Taxation of Trading Profits on January 16, sitting under the chairmanship of Mr. J. Millard Tucker, K.C. The Committee has divided its task into seven sections and is first examining whether income tax should be assessed (as at present) on the preceding year's profits, or on an average of a number of preceding year's profits, or on the actual year's profits. In general, the organisations representing the smaller industrial and trading units opposed any change from the present practice of assessing tax on the preceding year's profits, but the Federation of British Industries and the Association of British Chambers of Commerce presented a joint case for reform by abandoning the present method in favour of computing tax on the actual income of the tax year.

The recommendation put forward by the F.B.I. and Chambers of Commerce was:—That the basis of assessment for income tax should be the actual income of the tax year, accertained by apportioning the profits of the accounting periods of the business; that profits from the end of the last account on which the assessment was based before the change up to the first day of the tax year when the change is made should be omitted from consideration; and that losses incurred in that period should be carried forward for six years or such longer period as might be general. There were other consequential provisions that payment

in advance of the liability should be made before March 31 equal to four-fifths of the average tax liability of the two preceding years followed by a final adjustment when the accounts were filed and the liability calculated with appropriate dispensations for new businesses and for a material fall in profits below the average of the two preceding years.

Advantages of Present System

The Engineering Industries' Association, however, did not wish to have any alteration in the present basis. Many anomalies arose, it was stated, because the tax had to be met some considerable time after the end of the year in which profits were earned, but the advantages of the present system outweighed the disadvantages. The system advocated had little to commend it compared with the present basis, but consideration might be given to the idea of spreading back losses for six years, compared with one on the present basis.

The National Union of Manufacturers expressed an outright preference for the existing method; the actual-year basis was, on the face of it, attractive as it would remove the difficulties connected with commencing and ceasing businesses, but these cases were the exception and not the rule. The National Union of Mineworkers thought the current-year basis presented practical difficulties in regard to assessment and collection which outweighed advantages elsewhere.

MR. DANIEL HAY has been appointed to the board of the Aluminium Castings Company, Limited, Greenock, in place of MR. WALLACE FERGUSON, who has resigned.

British Blast Furnaces in the December Quarter, 1949—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast, December 31, 1949, making:—				Weekly average in blast.		Total built.	Furnaces relining.
	Hematite.	Forge and foundry.	Basic.	Total.	Dec., 1949, quarter.	Sept., 1949, quarter.		
Goldendale Iron	—	1	—	1	1	0·9	2	1
Lilleshall	—	1	—	1	1	1	2	1
Round Oak Steelworks	—	1*	—	1	1	0·5	3	—
Shelton Iron, Steel & Coal	—	—	3	3	3	3	3	—
Stewarts and Lloyds: Bilston	—	—	3	3	3	3	3	—
Total	—	3	6	9	9	8·4	13	2

*Making cold-blast pig-iron.

South Wales and Monmouthshire.

Briton Ferry Works	1	—	—	1	1	1	1	—
Guest, Keen, Baldwins: Cardiff	1	—	2	3	3	3	4	1
Thomas, R., & Baldwins: Ebbw Vale	—	—	2	2	2	1·9	3	1
Steel Co. of Wales: Margam	—	—	2	2	2	2	2	—
Total	2	—	6	8	8	7·9	10	2

Sheffield.

Park Gate Iron & Steel	—	—	1	1	1	1	2	—
GRAND TOTAL	14	27	57	102*	101·9	100·8	142	16

*Includes four making ferro-alloys.

Number of Furnaces in Blast on December 31, 1949

District.	Weekly average in blast, Dec., quarter.	Total in blast, Dec. 31, 1949.	In blast December 31, 1949, making:—			
			Hematite.	Forge and foundry.	Basic.	Ferro-alloys.
Derby, Leics, Notts, Northants, and Essex	25.4	26	—	20	6	—
Lancs (excl. N.-W. Coast), Denbigh, Flint, and Ches	5	5	—	—	3	2
Lincolnshire	14·8	15	—	—	15	—
North-East Coast	23	23	5	—	16	2
Scotland	8·7	8	[illegible]	3	4	—
Staffs, Shrops, Worcs, and Warwicks	9	9	—	3	6	—
S. Wales and Monmouth	8	8	2	—	6	—
Sheffield	1	1	—	—	1	—
North-West Coast	7	7	6	1	—	—
Total	101·9	102	14	27	57	4

Weekly Average Number of Furnaces in Blast during the Previous Six Quarters

District.	1949.			1948.		
	Sept.	June.	March.	Dec.	Sept.	June.
Derby, Leics, Notts, Northants, and Essex	25·3	24.4	25.6	25	25.6	25.7
Lancs (excl. N.-W. Coast), Denbigh, Flint, and Ches	5	4.9	5	5	5	5
Lincolnshire	14·6	15	14.2	14	13.5	13.8
North-East Coast	23	23	24	25·5	25.2	25.2
Scotland	9	8.8	8.2	9	9	9
Staffs, Shrops, Worcs, and Warwicks	8·4	9	9	8.8	8	8
S. Wales and Monmouth	7·9	8	8	7.6	7.8	7.7
Sheffield	1	1	1	1	1	1
North-West Coast	6·6	6·6	7	7.2	6.3	6.4
Total	100.8	100.7	102	103.1	101.4	101.8

The following companies have furnaces in course of construction:—Darwen & Mostyn, 1; Lancashire Steel Corporation, 1; Steel Co. of Wales, 1; Sheepbridge Company, 1; Consett Iron, 1; Skinningrove Iron, 1; R. Thomas & Baldwins (Redbourn), 1; Barrow Ironworks, 1; Cargo Fleet Iron, 1; J. Lysaght (Scunthorpe), 1.

MR. J. F. B. JACKSON, B.Sc., A.R.I.C., F.I.M., WHO HAS RECENTLY BEEN APPOINTED DIRECTOR OF RESEARCH TO THE RESEARCH AND DEVELOPMENT DIVISION OF THE BRITISH STEEL FOUNDERS' ASSOCIATION. DETAILS OF HIS CAREER WERE PUBLISHED IN OUR JANUARY 19 ISSUE.

News in Brief

IT IS REPORTED that G. Clancey, Limited, ironfounders and machinists, are to move their works in the near future from West Bromwich to Belle Vue, Halesowen.

WILLIAM JESSOP & SONS, LIMITED, of Sheffield, announce the appointment of Mr. D. W. Hammond as works director, and Mr. C. Whitaker as production manager.

LEY'S MALLEABLE CASTINGS COMPANY, LIMITED, Derby, on January 18 started up a new 100-ton per week melting furnace which is connected to a waste heat boiler.

JOHN THOMPSON (TRIUMPH STOKER), LIMITED, manufacturers of mechanical stokers, of Leeds, are building new premises on an industrial site owned by Leeds Corporation.

THE BRITISH WELDING RESEARCH ASSOCIATION are organising a "Research and Productivity" Exhibition at 29, Park Crescent, London, W.1, from Monday, February 6 onwards.

NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Glasgow, have received an order, valued at £250,000, for 18 locomotives for the East African Railways and Harbours, Kenya section.

MR. H. H. DAWSON, works director of Ransomes, Sims & Jefferies, Limited, engineers and ironfounders, of Ipswich, said recently that the firm's 1949 output was the highest ever reached.

J. W. JACKMAN & COMPANY, LIMITED, Vulcan Works, Blackfriars Road, Manchester, 3, have appointed Mr. E. Evans as their representative for the counties of Lancashire and Yorkshire.

TWO THOUSAND foremen and supervisors from over 600 companies in the Midlands attended a meeting organised by the Institute of Industrial Supervisors, at the Town Hall, Birmingham, on January 22.

M. & W. GRAZEBROOK, LIMITED, pig-iron manufacturers, etc., of Dudley (Worcs), will celebrate the bicentenary of their foundation in April or May. Parts of the company's original foundry are still in existence.

JOHN BROWN & COMPANY, LIMITED, Clydebank, are to make the first large-scale steel windmill in Britain for the generation of electricity for public supply, which will be erected on Costa Hill, Orkney, by the North of Scotland Hydro-Electric Board.

WHEREAS electrical and mechanical engineering and patternmaking were among the more popular trades chosen by boys leaving school, they showed little interest in ironfounding, states the annual report of the Middlesbrough Youth Employment Committee.

THE DEATH occurred at Salzburg recently of Dr. Gustav Krupp von Bohlen und Halbach, the former head of the family armaments firm. He was 79. By his marriage to Bertha Krupp in 1906 he obtained control of the concern and took the name of Krupp. He was judged to be incompetent to appear as a war criminal before the U.S. tribunal.

AT THE RECENT ANNUAL MEETING in Edinburgh of the Scottish Council (Development and Industry), Sir Steven industry in Scotland had made further progress and that the number of new jobs provided since the end of the war in new factories, extensions, and adaptations of all kinds now totalled 57,500. It was calculated, he stated, that additional employment to be provided by new factories and extensions would tend to rise by approximately 1,000 a month.

IT IS REPORTED that Alley & Maclellan, Limited, Glasgow, hope to secure from Clarke Bros., Olean, New York State, a subsidiary of Dresser Industries of America, permission for the manufacture under licence of a special type of gas compressor largely in demand for oilfields in the Middle East. It is understood that contracts valued at hundreds of thousands of pounds are dependent upon the result of negotiations which are now in progress.

Obituary

MR. JAMES KEITH ANDERSON, formerly of Fairbairn Lawson Combe Barbour, Limited, textile and general engineers, etc., of Leeds, recently died at Calcutta.

MR. ALEX. MUNRO-BROWN, brassfounder, died last week at the age of 73. He went to Falkirk over 50 years ago as junior partner in the Falkirk Brass & Sanitary Engineering Company, Limited, at the foundation of the company. At the time of his death he was secretary and a director.

Wills

SMITH, ALFRED, ironfounder, of South Shields £19,079

THURSFIELD, W. B., for 30 years in charge of the Kettering depot of Hall & Rice, Limited, ironfounders £2,563

FRENCH, W. H., secretary and a director of T. & C. Clark & Company, Limited, chemical-plant manufacturers, etc., of Wolverhampton £17,232

DRUCE, R. M. P., chairman and managing director of Miles, Druce & Company, Limited, iron and steel stockholders, of Acton, London, W.3 ... ... £71,247

PRESTON, SIR F. G. P., a former High Sheriff for Wiltshire, and for many years chairman of J. Stone & Company, Limited, marine engineers, etc., of Deptford, London, S.E.14 ... ... £221,527

LINDSAY, G., chairman of Carmuirs Iron Company, Limited, from 1923 to 1947, and for many years managing director of Charles Lindsay, Limited, hearth-furniture manufacturers, Glasgow ... £57,577

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With this forthright declaration, Sir Ellis Hunter, president of the British Iron and Steel Federation, concluded a vigorous address to the members of the Cleveland Institution of Engineers at a dinner at Redcar on January 19, which was attended by many leading men in the iron and steel industry, including Sir Andrew McCance, president of the Iron and Steel Institute, Mr. K. Headlam Morley, secretary of the Iron and Steel Institute, Sir Charles Goodeve, director of the British Iron and Steel Research Association, Mr. Richard Mather, chairman of the Skinningrove Iron Company, Limited, and Mr. J. J. L. Murray, president of the Cleveland Scientific and Technical Institute, with Mr. E. T. Judge, president of the Cleveland Institution of Engineers, in the chair.

Proposing the toast of the two organisations—the Cleveland Institution and the Iron and Steel Institute—Sir Ellis Hunter traced the early history of the local body, which was founded in 1864, five years earlier than the Iron and Steel Institute, of which it claimed to be the parent. There was, he said, no written evidence to prove that this was the case, but it was the first of the technical societies formed in various centres, and within 10 years had a membership of 307.

Iron and Steel Institute's Work

The Iron and Steel Institute had a long record of service to the industry which needed no commendation. Its standing throughout the world was a tribute to the work it had performed in encouraging improved techniques in iron and steel manufacture. The development of the industry, Sir Ellis continued, had not been one of inevitable and automatic growth, but had been stimulated from time to time by the inventive ingenuity of those engaged in the industry and by the research work of the chemist and engineer. The industry had had its trials and tribulations; it had alternately flourished and suffered adversity, but the overall picture was one of progress. They were the heirs to a fine tradition of which they could be worthy and which in their turn they could enrich only if they equipped themselves adequately for the task. The scientist and the engineer were coming more and more into the forefront of the picture in their industry, and it was a pleasure to him to associate with the toast Sir Andrew McCance and Mr. E. T. Judge, both of whom typified qualities which their industry needed to-day—scientific and engineering abilities of a high order. The important responsibilities they carried were a measure of the extent to which the industry recognised the value of scientific and engineering research. These gentlemen, and many others like them, were eager to help the younger men in the industry in their studies, and to give freely of their knowledge and experience to this end.

"It is true to say of the iron and steel industry in all parts of the country," said Sir Ellis, "that there is no industry where opportunity for advancement more freely exists for young men of ability who are prepared to work and justify promotion. Steps have been taken by the British Iron and Steel Federation to stimulate interest in, and to extend the opportunities of, training, but none of these facilities will avail the industry or the individual unless there is also personal effort. We live in difficult, indeed grave, times, beset with acute economic problems, and our greatest need to-day is individual endeavour for which there is no substitute.

"The public sometimes forgets that industry is not composed exclusively of capital and labour. In addition to those two important constituents, there are others almost equally important—management, scientific research, and engineering development—without which our industry would quickly become moribund.

"The contributions of the workers in these fields provide the stimulus and vitality which assures vigour and healthy progress. But they cannot flourish without freedom." Sir Ellis said that the function of the Government was to provide conditions in which industry was free to develop, while it was the duty of those responsible for industry to see that the natural abilities of those engaged in the industry could find free expression to the benefit of themselves and the industry which they served.

Planning Developments and Improvements

Sir Andrew McCance, in the course of his response, on behalf of the Iron and Steel Institute, remarked that Britain had often been accused of depending too much on other countries for new processes and developments. We had been accused of waiting for other countries to develop new ideas before we adopted them and then, of course, we had to pay tribute for those processes which constituted a drain on our resources.

There had been some truth in that allegation, but we were changing and he thought they could see to-day a determination to plan our own developments and technical improvements. Seventy or 80 years ago the world paid tribute to this country for the genius of Bessemer steel and he had every confidence that it would do so again. It would do so if their industry was left free to follow its own destiny in its own way; if it was not strangled and thwarted by political groups of men with few ideas and no principles.

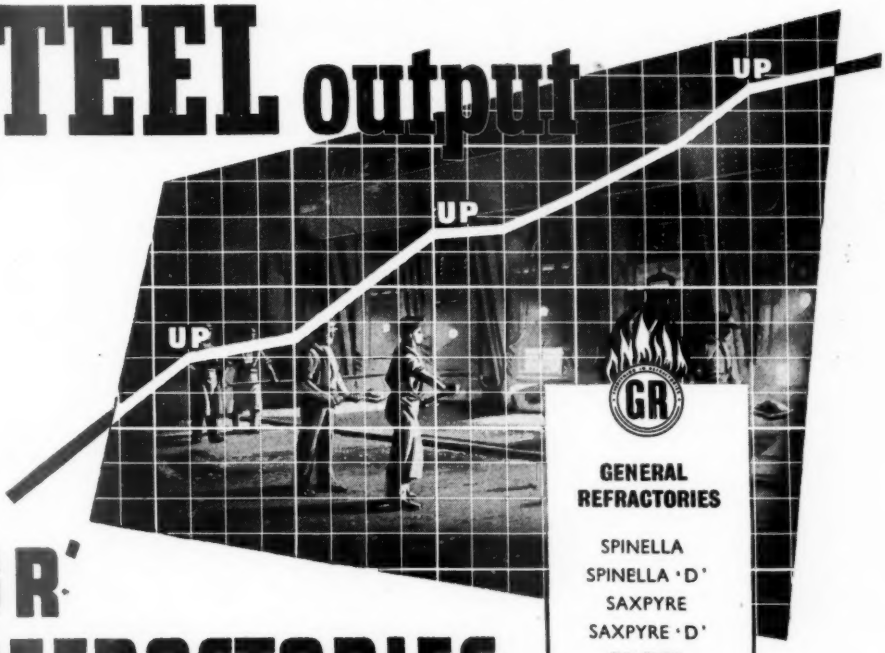
Mr. E. T. Judge also replied on behalf of the Cleveland Institution of Engineers, and Sir Charles Goodeve responded to the toast of "Our Guests," proposed by Major W. R. Brown.

Engineering Equipment Users Association

Five companies in the process industry field, namely:—Anglo-Iranian Oil Company, Limited; Courtaulds, Limited; Imperial Chemical Industries, Limited; Lever Bros. & Unilever, Limited; and Shell Petroleum Company, Limited; have formed an association called the Engineering Equipment Users Association. This organisation will provide its members with a means for exchanging information on standardisation of engineering materials and equipment which they use in common. The new association will work through the British Standards Institution on matters of general standardisation and will assist that Institution by presenting, as far as possible, the co-ordinated views of its members' representatives who serve on B.S.I. technical committees, etc. When experience has been gained, it is hoped that arrangements can be made for other user firms, who may be interested, to take part in consultations of this kind. Brigadier L. F. S. Dawes has been appointed secretary, and the offices are at 20, Grosvenor Gardens, London, S.W.1.

WITH THE CO-OPERATION of teachers, visits of school children from the West Bromwich area are to be made to the National Foundry Craft Training Centre at the works of Rudge Littley & Company, Limited, Swan Village, and to other selected foundries.

STEEL output



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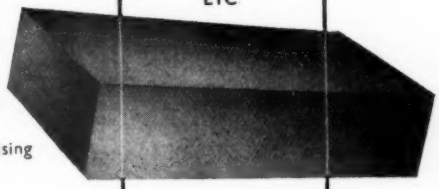

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Imports and Exports of Iron and Steel

Board of Trade Returns for 1949

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in December, 1949, and 1948. Total tonnages and values of exports in 1949 are also given

Total Imports of Iron and Steel

From	Month ended December 31.		Year.
	1948.	1949.	1949.
	Tons.	Tons.	Tons.
Australia	388	2,526	14,279
Canada	5,864	4,641	64,390
Other British countries and Irish Republic	186	2,062	25,119
Sweden	1,470	879	16,133
Norway	1,735	1,061	26,552
Germany	152	3,911	25,090
Netherlands	5,137	7,329	94,736
Belgium	28,146	11,449	335,858
Luxemburg	5,745	5,580	164,153
France	10,817	22,887	207,528
U.S.A.	5,404	5,438	242,960
Other foreign countries	178	894	36,027
TOTAL	65,222	68,657	1,252,825
Iron ore and concentrates—			
Manganiferous	4,000	—	3,006
Other sorts	491,248	685,119	8,695,682
Iron and steel scrap and waste, fit only for the recovery of metal	122,281	138,723	2,096,170

Exports of Iron and Steel by Product

Product.	Month ended December 31.		Year.
	1948.	1949.	1949.
	Tons.	Tons.	Tons.
Pig-iron	423	2,145	9,881
Ferro-alloys, etc.—			
Ferro-tungsten	203	114	895
Spiegeleisen, ferro-manganese	225	552	9,267
All other descriptions	67	92	1,035
Ingots, blooms, billets, and slabs	357	143	3,010
Iron bars and rods	693	379	6,819
Sheet and tinplate bars, wire rods	584	254	3,362
Bright steel bars	1,940	2,618	20,775
Other steel bars and rods	12,371	16,444	176,519
Special steel	1,345	1,422	15,002
Angles, shapes, and sections	10,824	11,186	117,931
Castings and forgings	490	456	8,048
Girders, beams, joists, and pillars	2,614	2,877	30,984
Hoop and strip	4,054	6,605	56,074
Iron plate	978	588	7,770
Steel plate, ¼ in. thick and over	22,860	16,735	221,316
Do., under ¼ in. thick	12,623	12,797	139,183
Galvanised sheets	6,535	9,655	93,218
Tinplates	17,183	18,388	194,702
Tinned sheets	701	119	3,408
Terneplates	6	18	301
Decorated tinplates	479	—	171
Other coated plates	201	439	6,937
Cast-iron pipes, up to 6-in. dia.	5,540	4,645	76,449
Do., over 6-in. dia.	7,393	5,709	82,337
Wrought-iron tubes	24,068	32,435	337,642
Radiators, central-heating boilers	191	312	3,810
Railway material	19,827	24,481	202,224
Wire	3,727	5,617	56,278
Cable and rope	2,326	2,533	30,651
Netting, fencing, and mesh	1,100	1,312	20,081
Other wire manufactures	1,280	1,204	13,273
Nails, tacks, studs, etc.	805	470	7,627
Rivets and washers	857	563	8,836
Wood screws	346	270	3,420
Bolts, nuts, and metal screws	1,813	2,129	26,486
Stoves, grates, etc. (excl. gas)	872	749	9,442
Do., gas	231	245	2,686
Sanitary cisterns	125	175	2,362
Baths, sinks, etc.	846	1,262	11,567
Fencing material	347	271	8,364
Anchors, etc.	628	690	9,816
Chains, etc.	739	747	10,365
Springs	823	562	8,108
Hollow-ware	6,020	7,323	83,603
All other manufactures*	18,161	19,310	243,221
TOTAL	195,821	217,040	2,385,256

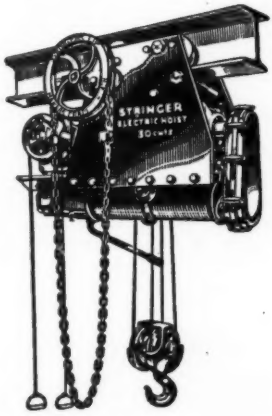
* Figures for 1949 are not completely comparable with those for previous years.

Total Exports of Iron and Steel

Destination.	Month ended December 31.		Year.	
	1948.	1949.	1949.	
	Tons.	Tons.	Tons.	£
Channel Islands	815	869	11,686	886,940
Gibraltar	322	115	1,771	135,297
Malta and Gozo	354	108	4,855	292,507
Cyprus	131	813	5,017	302,766
British West Africa	4,936	7,446	88,255	4,857,998
Union of South Africa	13,240	11,873	141,400	7,562,504
Northern Rhodesia	820	2,443	21,291	1,093,826
Southern Rhodesia	2,927	3,495	51,087	2,355,394
British East Africa	8,060	6,370	88,067	5,114,531
Mauritius	1,028	894	8,408	423,277
Bahrein, Koweit, Qatar and Trucial Oman	2,036	1,206	20,214	1,186,825
India	5,735	5,762	81,579	5,106,371
Pakistan	1,837	3,884	38,775	1,752,484
Malaya	5,450	6,879	61,131	3,294,346
Ceylon	2,095	2,809	26,926	1,397,714
North Borneo	574	198	9,307	484,922
Hongkong	2,863	4,463	36,505	1,779,968
Australia	8,101	25,853	197,390	10,973,991
New Zealand	7,899	15,334	120,462	5,712,510
Canada	3,322	3,224	65,728	2,629,250
Bermuda	89	90	884	85,739
British West Indies	4,210	5,540	63,227	3,332,861
British Guiana	437	205	4,566	320,213
Anglo-Egyptian Sudan	706	1,413	15,058	765,204
Other British countries	1,202	2,233	13,643	809,263
Irish Republic	6,131	6,841	69,612	4,650,280
Russia	3,572	170	9,154	478,243
Finland	8,639	7,219	77,047	3,517,465
Sweden	6,585	5,538	60,386	2,593,579
Norway	6,593	3,785	66,077	3,452,159
Iceland	873	348	7,746	425,211
Denmark	10,118	7,423	89,523	4,473,049
Poland	88	41	1,108	104,981
Germany	102	81	561	133,238
Netherlands	15,247	7,789	108,998	5,122,094
Belgium	951	1,395	11,580	1,157,657
France	1,844	1,772	31,951	1,846,361
Switzerland	1,612	934	12,677	1,050,730
Portugal	2,677	1,085	18,742	1,110,952
Spain	1,408	406	9,620	534,534
Italy	394	201	3,185	344,924
Hungary	4	87	1,051	172,727
Czechoslovakia	117	1	189	62,950
Greece	616	490	5,186	316,340
Turkey	2,888	1,025	17,849	995,007
Dutch East Indies	2,123	2,243	25,994	1,243,341
Dutch W. India Islands	919	1,071	8,830	464,153
Belgian Congo	168	172	1,716	155,674
French W. and Eq. Africa	19	73	496	35,225
Portuguese East Africa	406	449	4,632	306,792
Canary Islands	444	184	2,903	148,319
Syria	351	387	2,234	155,577
Lebanon	5,692	506	27,634	1,264,666
Palestine (Israel)	1,230	1,694	17,205	944,151
Egypt	4,547	6,398	58,597	2,622,317
Morocco	30	436	2,010	157,415
Iraq	1,554	4,010	51,082	2,452,650
Iran	3,132	18,125	162,943	7,629,681
Burma	1,252	707	9,316	578,633
Siam (Thailand)	664	467	5,933	326,949
China	1,594	175	2,873	170,986
U.S.A.	526	1,321	5,646	353,394
Cuba	36	25	466	46,965
Colombia	448	448	6,296	338,080
Venezuela	6,197	2,694	52,928	2,657,299
Ecuador	207	171	2,859	163,662
Peru	228	746	7,551	370,381
Chile	333	656	7,136	409,001
Brazil	1,520	2,365	19,527	1,302,784
Uruguay	1,048	498	8,119	571,939
Argentine	8,905	7,299	74,147	4,347,838
Other foreign countries	2,630	3,570	36,709	2,213,382
TOTAL	195,821	217,040	2,385,256	126,631,346

MR. WILFRED BAGNALL, chief metallurgist of Howell & Company, Limited, crucible tool-steel manufacturers, of Sheffield, who died intestate on October 4, left £16,026.

ELECTRIC HOISTS



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Raw Material Markets

Iron and Steel

Pig-iron production fluctuates within very narrow limits; in the aggregate it is not in excess of current requirements. Indeed, much bigger tonnages would be needed but for the fact that heavy tonnages of scrap are being supplied for use in the melting furnaces. There seems to be no immediate risk of the curtailment of imports of German scrap, but sooner or later these will diminish and the new and bigger blast furnaces now in course of construction will certainly be needed by the time they are ready for operation. At present blast-furnace men are well supplied with raw materials and are promptly clearing their full production.

Imports of semi-finished steel from Belgium and Luxemburg have been substantially reduced. Re-rollers are executing orders more rapidly than new business accrues and, consequently, are indisposed to add to already substantial stocks. Sheet mills continue to absorb large tonnages of slabs and sheet bars, but the call for billets has declined as a result of the waning demand for small bars and light sections. This may be only a temporary phase. The export trade is probably capable of expansion under the bilateral trade agreements, but Belgian competition is very keen and most of the re-rollers are marking time in regard to further purchases of material.

The heavy rolling mills have orders in hand which assure full-scale activity for several months ahead, and the heavy ingot production is being fully processed. Pressure on plate-mill capacity is intense and bookings for heavy joists and sections leave little scope for the execution of further specifications before April next. Additional orders for rails for Canada are expected to mature very shortly and, indeed, the overseas demand for rolling stock and all classes of railway equipment is one of the most impressive features of the market. Sheet mills can only accept a tithe of the business offered by home and overseas consumers and wire mills are in a similar position.

Non-ferrous Metals

The United Kingdom price of zinc has been reduced by £2 to £85 10s. per ton, following a downward move in America from 10 cents to 9¼ cents per lb. Business in zinc appears to be fairly brisk and consumption is maintained at a good rate. In copper, too, there is no complaint so far as usage is concerned, but there can be no doubt that the fabricators are keen to take advantage of the price concession obtainable in melting secondary metal. The margins between scrap and virgin metals have narrowed recently, but, nevertheless, there is still some advantage to be secured by the purchase of scrap.

Considerable interest has been aroused in metal circles by the announcement that the Ministry of Supply is planning to sell in one lot some 40,000 tons of war-time surplus secondary metal. It would appear that the present rate of disposal, believed to be at about the same rate as arisings, *viz.*, some 4,000 tons per month, is not sufficiently rapid, for it leaves the stocks on hand at Ministry depots untouched; at the end of last year there were about 40,000 tons of various grades of secondary metal awaiting disposal. The present method of selling Government secondary metal is by tender and, in view of the evident anxiety of consumers to secure scrap material, it is possible that some other method, similar to that obtaining during and immediately following the war, would enable the authorities to liquidate their holding more quickly.

There is as yet no news of any steps by trade interests to put forward proposals for enabling the Ministry to get rid of its 40,000-ton holding, but it is believed that the matter is under discussion by the merchants. It would seem fairly certain that disposal of such a large tonnage in one lot could not fail to depress values all round.

Tin trading continues to be quiet and the turnover is very modest. With the cash quotation held around £600, interest, so far as price change is concerned, is centred mainly in the forward position. Although the backwardation continues to narrow, there is still a long way to go before the market can be attractive for hedging purposes. Indeed, it seems as though this onerous premium for the cash position will not be eliminated before March.

Metal Exchange tin quotations were as follow:—

Cash—Thursday, £599 10s. to £600; Friday, £600 to £600 10s.; Monday, £599 10s. to £600; Tuesday, £599 10s. to £600; Wednesday, £599 10s. to £600.

Three Months—Thursday, £583 to £583 10s.; Friday, £584 to £584 10s.; Monday, £582 to £582 10s.; Tuesday, £581 to £581 5s.; Wednesday, £581 15s. to £582 5s.

B.I.S.R.A. Appointment

Dr. J. Pearson has been appointed head of the chemistry department of the British Iron and Steel Research Association in succession to Dr. F. D. Richardson. Dr. Pearson has been head of the chemistry section of the B.I.S.R.A. laboratories at Sketty Hall, Swansea, since 1946, where he has worked on the disposal of spent pickle liquor, gas pickling of steel, and preparation of replicas for surface-finish assessment. He is a graduate of London University and has previously worked with Tube Investments, Limited, and with the armament research department of the Ministry of Supply at Woolwich. He received the degree of Ph.D. in 1946 for research on the polarography of nitrocompounds.

Forty Years Ago

In our issue of February, 1910, there appeared an article by an author using the initials J.F.P.L. which is unmitigated "tripe" in the light of later developments. He puts up a completely puerile case against anybody using steel in the cupola. He called the mixture "pig-iron steel" and his references to German practice are nauseating. However, by way of contrast, there is an exceptionally fine description of the foundry of Sulzer Bros., of Winterthur, which even then had dust extraction in the fettling shop. Again, there is a good article by A. Napier on running methods to give clean castings. Among new companies registered were W. Firmin & Sons, Limited; Hepworth & Grandage, Limited; and H. J. Oxley & Company, Limited.

Institution of Metallurgists

The next examinations for the Licentiateship and Associateship of the Institution of Metallurgists will be held from August 28 to September 4, 1950. Candidates must submit their applications for permission to enter the examinations before June 1, 1950. Each application must be made on a form to be obtained from the registrar-secretary, Institution of Metallurgists, 4, Grosvenor Gardens, London, S.W.1, and must be accompanied by a registration fee of one guinea. The balance of the examination fee will be payable before August 1.